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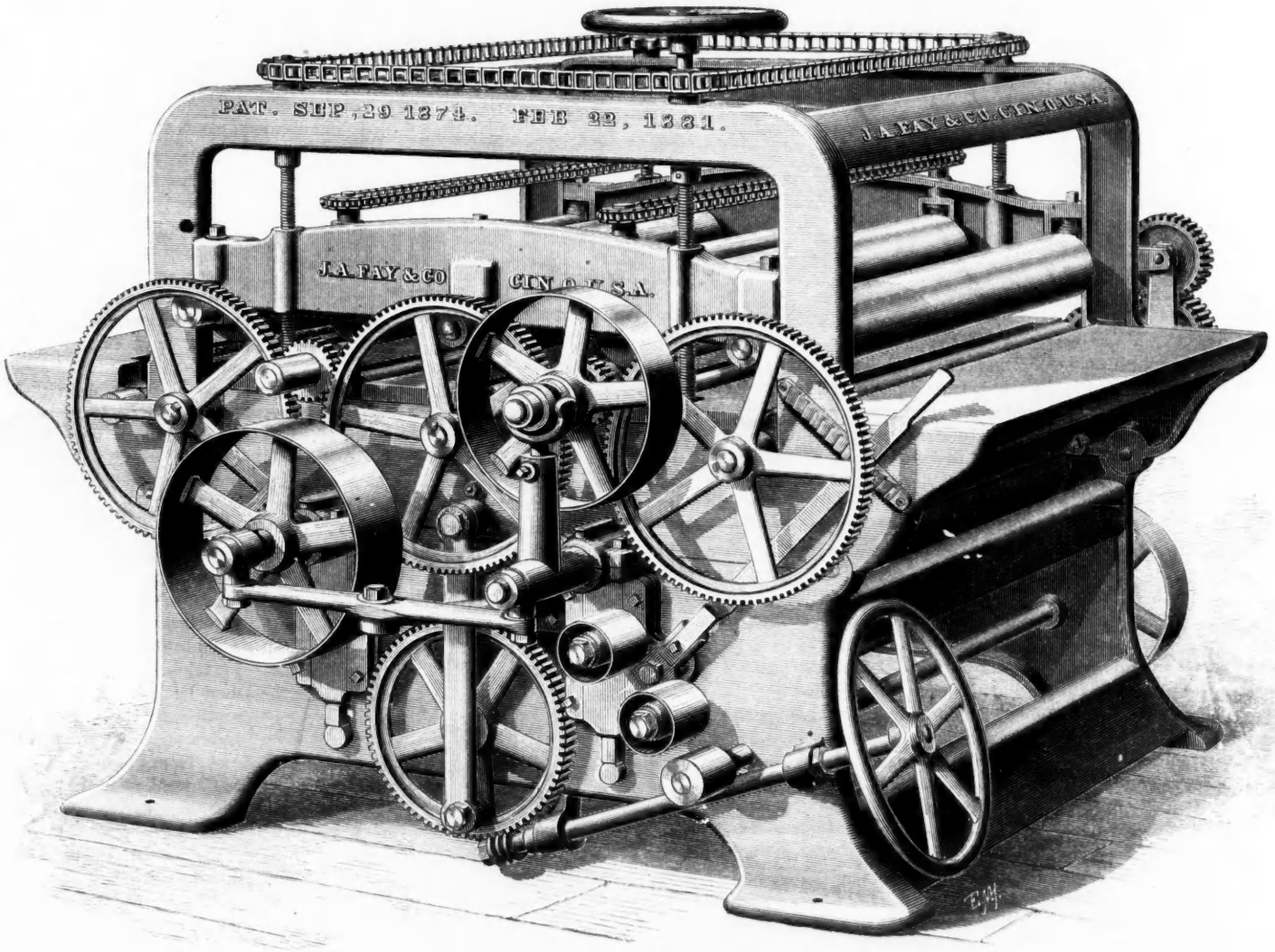
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Double Drum Sand-Paper Machine.

In no department of mechanics and machine construction have the improvements been more rapid and varied, or more remarkable and numerous, than in the manufacture of wood-working machinery. Especially is this true in this country. As the merits of some of our best American machines have become familiar abroad, their introduction has been rapid, and their importance and usefulness as a means for dispensing with a great amount of manual labor have been promptly appreciated. Some of these machines are, indeed, wonderful in the saving of labor, a single machine doing the work of, in some cases, even 100 men. The illustration herewith presented is a specially new design of a wood or surface-polishing machine, designed by J. A. Fay & Co., the extensive wood tool-builders of Cincinnati, O. It is for reducing to a finished surface (after planing) material up to 48" in width, leaving it ready for the varnisher. A few years ago many would have doubted the possibility of the construction of a machine that would produce a finished surface upon lumber, doing all the work of the hand-finisher even better than was possible for him to do it, and leaving it ready for the varnisher.

This is a massive machine and has a powerful feed, consisting of six feed rollers, which are mounted in two independent housings or frames, the upper frame containing the upper feed and pressure rollers, the lower frame containing the lower rollers and polishing cylinder. These are connected by expansion gearing on one side, and by a heavy train of gearing upon the other. The polishing cylinders are two in number, both arranged with a lateral vibratory motion; also with a brush attachment for cleaning the material as it leaves the machine. The hand-wheel on top adjusts the feed rolls and pressure rolls simultaneously. The hand-wheel at the bottom is connected by a worm to a segmental gear in such a position that by turning a crank either end of the machine can be elevated, affording immediate access to the polishing cylinders which are placed in the body of the machine. Different grades of sand-paper are used on each cylinder—a coarser grade upon the first cylinder and a finer grade on the last cylinder. It is a most powerful machine in action, easily operated, and the character of the work produced is most excellent. For all cabinet and inside finishing of hard wood, on flat surface, or in wide panels and doors, and a variety of other purposes, it will be found very useful.



DOUBLE DRUM SAND-PAPER MACHINE.

Eduardo Thiers, engineer-in-chief of the proposed harbor works at Vera Cruz Mexico, has sailed for Europe to order the apparatus necessary for carrying out the work.

Working to Standards in Large and Small Shops—Early Sewing-Machine Economies.

BY S. W. GOODYEAR.

May I cast in my pebble to further widen the ripple which must have been caused by Chordal's reference to the subject of standards in the manufacture of machinery? In many of our Eastern shops, the question of the entire practicability of working to standards has for years been settled beyond the possibility of argument. In many other Yankee shops the war for and against it is hotly waged, with no signs of yielding on the part of the "powers that be," who still believe in the accuracy of scribe and prick-punch, rules and calipers, and the wonderful skill of their "best men." No standard gauges for them, nor micrometer calipers, nor measuring machines, nor any other modern foolishness; and don't they wish that "they could hire some men now as good as those employed by them thirty years ago."

There are still other shops where the matter is being carefully and intelligently investigated, because it has been learned that working in the old way neither produces as good work nor as much of it, and as both price and quality stand in the way of successful competition, the question is raised, Why?

Can some needed light be thrown upon this perplexing subject? Do all who write upon the subject of working to standards of size and distance, and who indulge in long and wordy warfare, get the exact practical bearings in the case? Do not too many look in the wrong direction for the real substance, and seeing what seems to them but a shadow, condemn the whole system without understanding it? Standard gauges, duplicate, or triplicate, are merely for reference; they accomplish nothing except to decide when work is being made and kept up to standard. Chordal's word sample is right, given an adjustable device with which to measure the sample, and by which the measurement may be accurately read and put down in black and white to mean the same wherever inches and feet and fractions thereof are in vogue.

Is not the real substance of this whole matter contained in the sundry and divers devices used for producing any number of parts practically alike, and more rapidly than can be done without them; in jigs, milling cutters, singly and in gangs; starting taps with stems accurately fitting the drilling preceding the threaded portion and insuring the tapping of the holes, both centrally and in line with the drilling? Holes may be tapped in this way with a full confidence that they are right in a fraction of the time occupied in turning the head from one side to the other and squinting at a try-square to be sure

that after all not one time in a hundred is the tapping just right? Not always great things, but extremely little ones, are some of these devices. Not patented, nor patentable; very many of them not originating in the brain of some high-priced man employed for the purpose, nor having passed through the hands of designer or draughtsman, but coming from the plain mechanic, who, with upturned sleeves and grimy brow, is continually thinking of plans for expediting and cheapening the work in hand. These little things work wonders in the production of work.

I helped to build the first fifty successful sewing machines put in market by one of the since largest and most successful sewing machine manufacturing concerns in the world. We measured, and laid out, and scribed, and drilled, and cut, and tried, and guessed by box-wood rules. Well do I remember how near I came to shedding tears of vexation and wounded pride at the contemptuous treatment received from the foreman by a steel scale bearing the trade mark "D. & S. Bangor," with which I had just provided myself. He also gave me a blowing-up for grooving some taps. Said he: "Don't make any more such taps for me. The way to make taps is to just file off the thread on four sides, making them square."

This was not the only way in which we jammed and crowded metal away, and tore it off instead of cutting it. Needles were made which cost two hundred and fifty dollars per thousand, and even after the needle department was pretty well organized, more money was paid for the bare work on a single thousand needles than will buy in market to-day ten thousand vastly better ones.

Screws were made by centering a piece long enough for two, turning them up in the lathe, cutting the thread, finishing with a jam plate made of an old file, cutting in two, and nicking, many times with a hack saw.

But bye-and-bye somebody got a job there who had seen drilling jigs, and filing jigs and a screw machine, and had an idea that a great deal of the work done on needles by filing could be done by milling. "Step by step, here a little and there a little," improvements crept in, until it came to be said that an amount of work which formerly cost the company nearly ten dollars was being done for one dollar. As improvements continued, it was found that machines in which the parts were alike could be assembled, and adjusted, and put in order to sew in a fraction of the time formerly taken.

After a few years spent in this school, I found myself in a shop where several styles of sewing machines were to be made, all of them cheap machines. One of them retailed at five dollars, another at fifteen dollars, and two others at twenty-five and thirty-five dollars, respectively. Here was a necessity for some other than the old plan of working, but at the same time the plans adopted must not be too expensive. Such machine tools as we had must be utilized. Commencing with this concern as a tool maker, I developed into a contractor, taking my first job at twelve dollars per hundred pieces, when the proprietor frankly told me that the lowest figure he had been able to get named by any other party was sixty dollars. Several of my competitors had thought the job worth over one hundred dollars.

Said the proprietor, "I don't believe you can make wages at that price, but go ahead, and if you don't come out all right I'll make it up to you." The company were to stand the expense of special tools and fixtures, and I was to have the privilege of making what I chose.

Bending, which had been done by placing a piece in the vise to a scribed line and knocking it over with a hammer, getting no two alike and not one square, was shifted to a little hand planer, and on this, by the use of a fixture which cost but a few hours' work to make, the pieces were clamped all exactly in the same position by a turn of a lever cam and strap. With a fixture in the tool stock carrying a friction roll with a flat groove of the exact width of the piece to be bent, I had only to make a turn of the wrist to fasten and release the piece, and a pull of the crank, and the bending was done. No matter how many pieces were bent in this way, they were practically alike, and square, and one thousand could be bent in less time, than it had formerly taken to bend one hundred, no two of which were alike, and which required more time spent on them in squaring them up afterwards than it had taken to bend them.

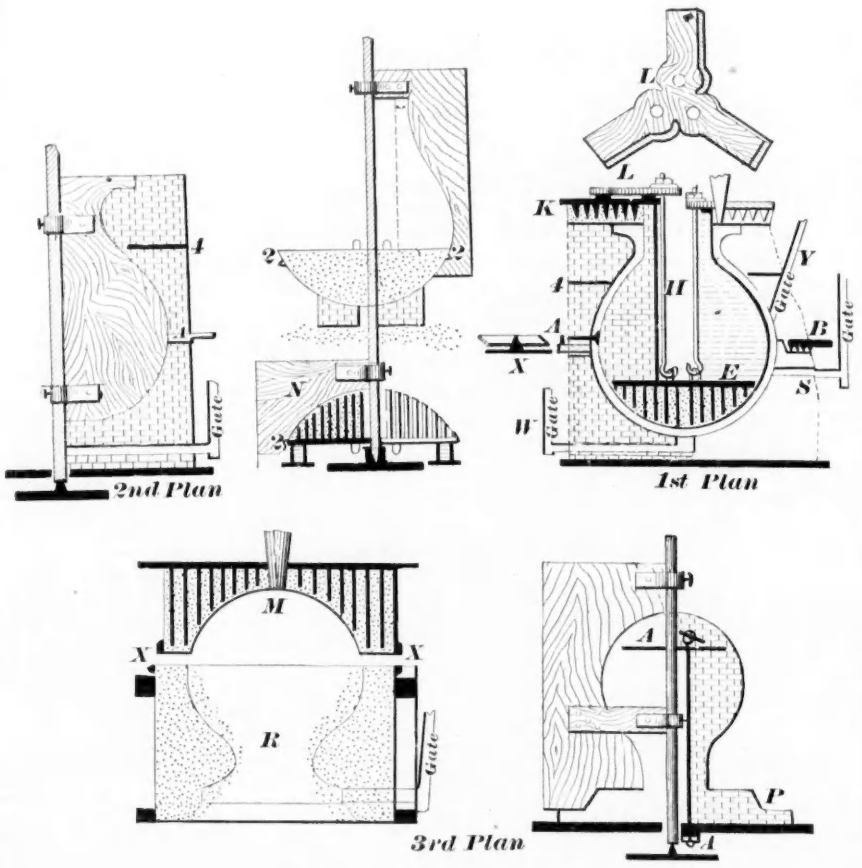
Next came the milling-off of edges to bring them parallel, and to bring all the pieces to a width. This had been done in a milling machine by first milling one edge and turning the piece to mill the other. Giving the milling machine the go-by, I put two cutters at the right distance apart on an arbor, put the arbor in a lathe, made a fixture to take the place of the tool post, having a stud with broad shoulder and collar and nut projecting from its side in a plane with the arbor. On this stud hung a lever, the front end of which was provided with gauge pins by which to set the piece, and a strap and cam lever with which to fasten it in place. The back end of the lever was of suitable length for convenience. Here was a device attached to an old lathe not fit for good work, all the fixtures costing but a few dollars, by which, simply laying the piece in position and clamping, then passing the piece between the milling cutters by working the lever, very nearly as many pieces could be done in an hour as had been milled by the easy-going "by the day" plan in ten hours.

I made bigger pay on this job than I had ever hoped for. It was in the hard times of 1857 and 1858. I was urged to take other jobs, which I did. Sewing machines were built of some sorts by the twenty-five, or one hundred, and no more. Other kinds were first *built* in sample lots, and afterwards *manufactured* by the thousand. Who supposes that these machines came together like clock-work, as they did, as like as need be, because there had been $10,000 or $12,000 spent in models and duplicates, or triplicate sets of gauges for each kind of machine? Why, there was hardly a hundred dollars' worth of the kind in the whole establishment. The jigs, and fixtures, and methods, were what accomplished the desired ends, and the trying together of parts stood in the place of an expensive system of gauges. There are no stronger advocates of standard gauges and means of close measurement than myself, but they can only be useful in connection with correct methods for producing work accurately.

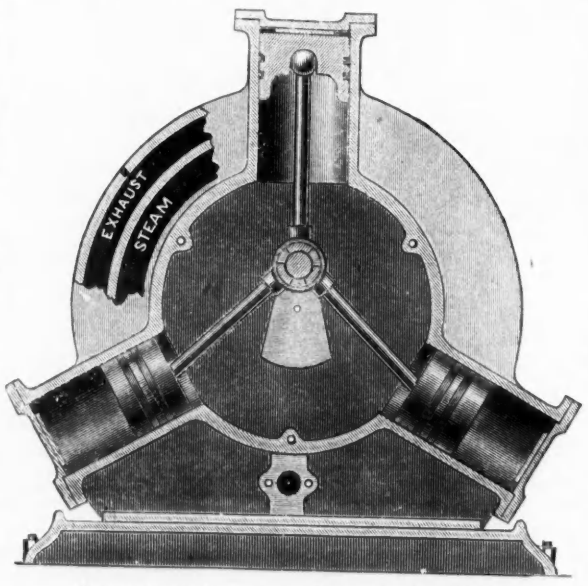
That special machines for doing the different parts of manufacturing light machinery are desirable, and thousands of dollars expended in costly gauges and models are good investments; while it is policy to have every jig finished up all over—even to oil-stone quircums—for large companies with millions of dollars of capital, I do not propose to dispute

I contend, however, that lack of means to make such expenditures debars no small concern from making such tools and fixtures, and adopting such methods as will of themselves act as the best of standard gauges, in that they produce parts wanted practically alike, and properly used can produce nothing else.

Starting with this as an expression of my belief, I may in future give your readers some detailed descriptions of how, in many years spent in designing and perfecting plans for producing parts to standards, I have found it possible with fixtures costing but a few dollars, attached to the ordinary tools already in use, to get out better work, and practically to standard, at the same time getting out from two to ten—in some cases even twenty—pieces to where one had been made by skilled workmen in the old way.



MAKING AN AIR VESSEL.



SECTION OF GARDNER ENGINE.—See Page 3.

Three Ways of Making an Air Vessel.

BY ROBERT WATSON.

In making a casting like the one shown in the engraving, three things suggest themselves to the moulder: First to *make* it, second to make it well, and third to make it at the least expense, and at the same time have a good job of it. There are three plans represented in the engraving for making this air chamber, which it may be remarked is of a size not often required, the dimensions being 60″x48″ and 2″ thick. The moulder who made this particular casting made it in loam, by the first plan represented. This is a plan considered by some old fashioned—out of date; while others maintain it is the safest plan, although a rather slow one. I will explain the three plans, and leave it for the readers of the AMERICAN MACHINIST to judge which is the best.

In making this casting by the first plan, we build up to *A* and *B*, and after loaming and sweeping smooth it is necessary to wait till the loam is stiff enough to bear the weight of the core. By drying it with a fire basket a little time can be saved. Then it is blacked with a mixture of charcoal blacking and water, for the purpose of making it part clean. The sweep is then changed so as to sweep the required thickness, which in smaller castings is often done with green sand dampened with clay water, but I doubt if this material would be strong enough to sustain a core of this size. To be on the safe side it is better in this case to use loam and brick splinters, and to thoroughly dry with the fire basket. Then a coat of parting blacking is put on, and it will part cleaner if a coat of parting sand is sprinkled on.

To build the core a plate with prickers on it is used to form the bottom, as shown at *E*. There are different ways of bedding this plate I have seen them bedded cold in a body of loam, but this requires a long time to dry hard enough to lift clean when the core is taken out of its bed. A better plan is to heat the plate, and have holes in it in which to pack pieces of bricks and loam, up level with the plate. I think a better way still would be to turn the plate bottom upwards and loosely pack in bricks with building loam, freely using fine coke, up to within 1″ or 1½″ of the points of the prickers, then fill up with loam in a rough state. When dry and ready for use it is necessary to scratch the surface of the loam with a wire brush, and rub on a little soft loam. Then lower it on a loam bed, say from ½″ to ¾″ thick. The remainder of the core can then be built with confidence in the final result. A sweep has to be put on the spindle and used to form the upper portion of the core, from the joint *A* and *B*. Space must be allowed in the center for the lifting and blocking gear, as shown at *H*. After loaming and sweeping this part of the core the sweep must be changed for another, to make the proper thickness.

I have seen the same operations gone through with as were with the bottom—drying the core, putting on parting blacking, loam, brick splinters, &c., but all this in the case of the core is quite unnecessary. Instead of loam for the thickness, use green sand dampened slightly with clay-water. Press this on firmly with the hands, and sleek a little with the trowel after the sweep has properly shaped it. No parting blacking is required. Before sleeking it, if parting sand is sprinkled on, it will assist in getting a clean parting.

You can now start without delay to build up against it to form the outside, after putting on the parting ring. When at the top, if you have no sweep, it is necessary to have a ring to form the flange. The job is then so far complete. After marking in several places, great care is required to part this off, as the mould is green and easily damaged. This part should be dressed and blackened first, as it must be dried. When this is drying, the upper half of the core can be dressed and blackened, then put the cope part back in place.

The loamed top plate, *K*, is placed on the top for the purpose of lifting the core out of

its bed. I have seen two bolts used for lifting the core, the bolts being screwed tight on the top of the plate. The position of these bolts is shown at the right of *H*. This plan was not satisfactory, and far from being safe, as it is impossible to screw the bolts so as to have equal strain on them, therefore the core is liable to move when free from its bed, by the effort to come to an equilibrium. If it does move, there is a poor chance of adjusting it with two bolts. A better way would be to use three bolts, then it can readily be adjusted. By having a strong piece of iron alongside each bolt, extending from the core plate and tightly wedged, the bolts could be tightened to suit, with confidence that the core will not move from its proper place. This is shown to the left of *H*.

If the top plate is not strong enough, it would be a good plan to use a three-legged cross, as represented at *L*. This, by bearing on the points of the legs as well as at the center, would strengthen the plate.

Two ways of making joints are shown at *A* and *B*. Some make a beveled joint, as at *B*, the beveled part serving as a guide in lowering. This is generally satisfactory when there is a good foundation. There is at *B* a chance of getting a poor flat joint from the prickers not lifting the loam; also, when closing, there is danger of crushing the level part, if not closed entirely fair, which will spoil or disfigure the casting. The level joint at *A* is far better. This is made with two plates, the bottom one bedded firmly in loam, which makes the joint iron and iron. It can be guided together by outside marks. A better way of guiding would be to have pins, as shown at *X*. To make these plates, have a bed with the size and form marked on it, and high enough to cast two plates. Before casting the first plate set the guide-pins so the plate will have a good hold of them. The upper portions of these pins should be oiled, and a good coat of parting sand put on them. After the first plate is cast, put on a good coat of parting sand to prevent the plates uniting. There can be three or four lugs cast on the upper plate, as shown at *A*, for the purpose of wedging chaplets.

In this plan there are shown three ways of running the casting, as at *S*, *Y* and *W*. The runner at *S* is almost sure to cut and scab the core and mould. The runner at *Y* is not so bad, but is open in a less degree to the same objection. I can with confidence recommend the runner *W*.

Looking at the second plan in the engraving, the core and the mould are made separate. The bottom of the core *N* is formed with a sweep. When this is dry and turned over, it is laid on a bed prepared for it, care being taken to have the bed quite level, and placed centrally with the sweep. To insure its proper location a nick may be made in the sweep that forms the bottom, to correspond with the top sweep, as shown at 2, 2, 2.

For supporting the core, a plate should be built in its upper portion to bolt to the bottom plate, as shown at 4. In the third plan, the mould is made in three parts, the bottom when finished is divided into two sections, one of which is shown at *R*. The four lugs are to clamp the sections together by. The top part can be made by having a plate with prickers on it as shown at *M*. For closing by, the sweep should be made to make an outside mark to correspond with the under part, as shown at *X*, *X*.

Although the third plan seems to be the easiest and simplest it is seldom adopted, for the reason that the bottom being the weakest part, or the part most likely to give way from overpressure, it is essential to provide for its being sound and solid, and the only way to do this is by casting the bottom down as shown in the first and second plans.

There was so much obstruction to railroad operation last winter by heavy snow, that the inventive genius of the whole continent seemed to be devoted to the labor of devising means for vanquishing the beautiful snow next time it comes to earth too profusely. The result of this inventive industry was a great crop of snow plows, which competed in prominence with car couplers and car brakes. Some of the devices invented to clear away snow were absurd, and were evidently got up by men who never saw a severe snow-storm, or, at least, never realized its terrors and magnitude. Others are commonplace concerns, such as every Northwestern road has been using for thirty years, and how they came to be patented is a mystery which no fellow out of the patent ring can find out. Several of the plows aim at shoveling the snow by power, scattering it away from the track, and digging a passage for the train. One notable plow of this kind has had no small degree of mechanical constructive skill expended upon its arrangement. It is called the Hawley steam snow-plow and excavator, and is a Canadian invention, although the headquarters of the company are in Rochester, N. Y. The excavator consists of a heavy sheet-iron screw, with wide pitch, which stands vertically in front of the plow-car specially adapted for the work, and the screw is revolved by a powerful double-cylinder high-speed engine, which acts horizontally under the bottom of the car. The rationale of the invention is, that the plow, which is all iron, shall be pushed in front of heavy locomotives that will keep it up to the snow, when the rapidly revolving screw will cut an opening in the drifts and throw the snow away from the track.

A leading railroad manager says that he would go a thousand miles to see it working in a heavy snow-bank.

The Gardner Three-Cylinder Engine.

We present with this, engravings representing two of the Gardner engines, as arranged for different purposes. Fig. 1 represents this engine as arranged for use as a stationary motor, or for special use as a hoisting engine, for operating elevators, for electric lighting, &c.; and Fig. 2 its adaptation for steam yachts, reversing hoists, or for any purpose where a reversing engine is required. On page 2 is a transverse section through the cylinders and case.

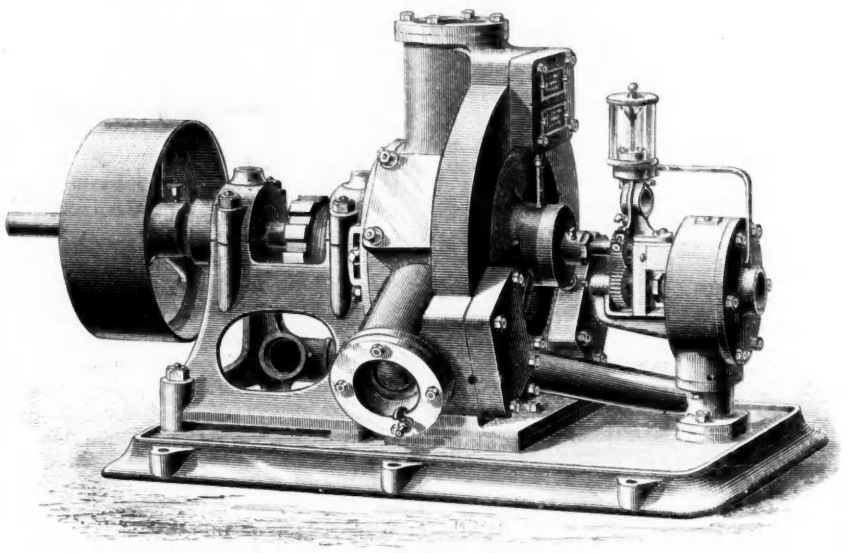


Fig. 1.—Gardner Stationary Engine.

From these it will be seen that three cylinders are employed, their pistons all connecting through their rods to a single crank pin. The pistons are unusually long, forming all the guides that are required between their rectilinear motion and the revolution of the crank. The cylinders are single acting, taking steam on their inward stroke only, and are cast in one piece with the case, which insures them against change of alignment, and does away with bolting or fastening them in place.

The crank end of each connecting rod is provided with a section of the crank-pin box, these sections being held together by light straps or rings over their ends. The upper ends of the connecting rods are in the form of a ball, fitting in balled bearings near the center of the pistons. The pressure on the pistons being in one direction only, and that inwardly, the strain on the rod is that of compression alone, so that lost motion will not affect the running, or, in fact, lost motion in the connecting-rod journals cannot occur.

The valves—three in number—are plain flat slides, and are all driven by a single eccentric. This eccentric is a collar fitted to the shaft, in one face of which an eccentric groove is turned. In this groove are fitted corresponding circular sections, to each of which the inner end of an eccentric rod is attached. So far as revolution is concerned, these sections remain stationary, hence there is no vibration of the eccentric end of the rod, and no joint of any kind is required in the rod, the connection being direct to the valve.

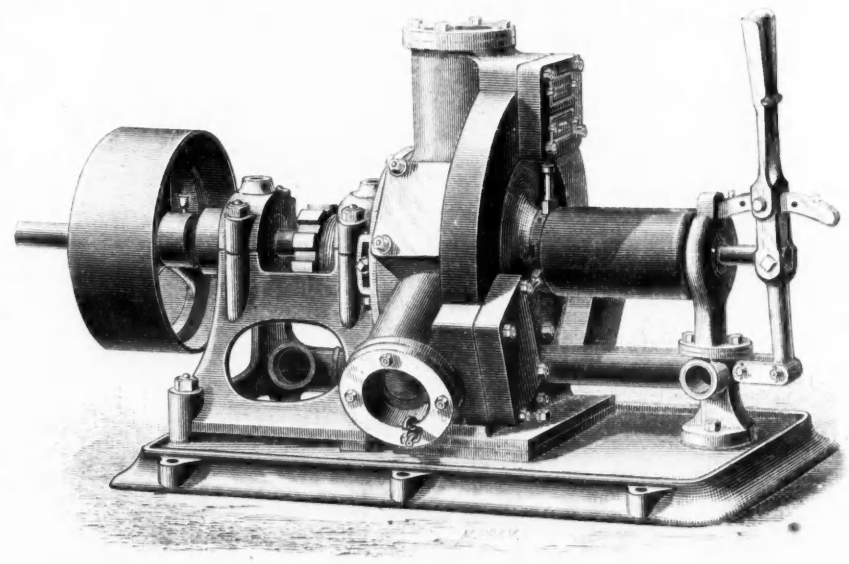


Fig. 2.—Gardner Reversing Engine.

The end of the crank shaft that carries the eccentric is reduced in diameter, as it has no work to perform except to drive the valves and governor. The bearing for the main journal consists of a tapered sleeve, in sections longitudinally, and fitting a tapered seat. Compensation for wear is made by screwing up the grooved nut shown, which forces the tapered sleeve into its seat, and consequently closes the sections on the journal. The governor is positively driven by means of gears, thus avoiding the trouble of slipping belts, or the accidents of broken belts.

The reversing engine, Fig. 2, is reversed in its motion, or worked with any degree of expansion required, by the use of the lever shown, which moves the small rod extending into the crank shaft. This rod in turn operates wedges in such a way as to move the eccentric across the shaft. To make this engine automatic, the governor is connected to this rod.

When the reversing engine is used for a steam yacht, the small amount of room required in height is a feature of considerable importance.

The construction of these engines is simple, and such that they are not liable to derangement. Although three cylinders are employed, it will be seen upon examination that the parts are few. The engine occupies but little floor space, and from the equalizing action of the three pistons only a comparatively light frame, light fly-wheel, and inexpensive foundation are required. Since there is no change in the direction of pressure, pounding in the connecting-rod boxes is avoided, and it will run quietly and safely at high rotative speed.

The working parts are inclosed, and thus protected from dust, and the absence of bolts, gibs or keys in the connecting rod removes danger of accident from this source. There are, of course, no dead points, the engine starting readily from any position. The only parts of the engine that require packing against live steam are the valve stems, for which convenient arrangements are made. The exhaust steam is discharged into the case, which is packed against that pressure only. The valves and pistons are oiled by means of a positive pump, which is adjustable in stroke so as to feed the exact amount of oil found necessary.

Although the stationary engine is represented with a band wheel, it is evident that it is a very convenient construction for direct connection, the high speed and correct balance being favorable features. The fact of its being self-contained and easily located in a small space, is favorable for its use for special purposes and for subdivision of power.

These engines are manufactured by R. Dunbar & Son, Buffalo, N. Y., and sold by C. M. Morse, 12 Cortlandt street, New York.

Mechanical Instruction at Girard College.

We have made inquiries with reference to the Department of Mechanical Instruction at Girard College, Philadelphia, and learn that although started only about one year ago there are at present under instruction 160 boys from 12 to 17 years of age, and that during the year quite a number have found employment in machine shops under instruction for a term of years.

A systematic course of instruction is pursued, in the use of the simpler tools first, working up to the more difficult. Nothing is manufactured for sale, but when a boy has done a creditable job it is placed on exhibition.

The present plant of tools consists of a 20"x20"x5 foot planer, a 16" screw-cutting engine lathe, a shaper, drill press, grindstone, 30 vises and the necessary small tools. There is a tool-room from which the students obtain their tools as in well-regulated machine shops. The school rooms are now located in the basement of the building, but a new building is about to be erected with greatly increased facilities. In the new building not only finishing but pattern-making, blacksmithing, moulding, &c., will be carried on, and the instruction will embrace mechanical drawing, steam engineering and experimental mechanics.

In our issue of June 2, 1883, we published an abstract of a paper read before the American Society of Mechanical Engineers, by Prof. S. W. Robinson, on "The Back Pressure on Valves," omitting the higher mathematical formulas. Those who are desirous of obtaining the paper complete, with these formulas, will find it in *Van Nostrand's Engineering Magazine* for July.

Tempering Swords—Rolling Swords.

CRYSTALLIZATION AND OTHER CHANGES OF STRUCTURE—EFFECTS OF BLOWS AT DIFFERENT HEATS—USES OF STEEL.

BY B. F. SPALDING.

The process of forging swords has been described in a former paper, the description concluding with the remark, "As far as the forging was concerned the swords were now done."

But although they were forged, they were not yet out of the flames, for, after having such of the roughness removed from them as could not easily be taken off after they were hardened, they were carried to the temperer. It was his business to give them their real value. They might by etching, by fine engraving or by the addition of silver, gold or gems be made more costly and valuable as ornaments, or time and associations might, as years went on, give them an extraneous value as relics, but taken simply as swords their whole worth depended upon the excellence of their temper.

A thousand men may be tried as temperers and fail. With the very best of intentions and laborious effort they seem to be inspired to do poor tempering, while some one else without effort will do good tempering, seemingly by intuition. Boys from the farm have been known to do tempering which old careful blacksmiths failed on.

It is only persons who are found to be successful who are trusted with the tempering of swords.

The blades are heated to an even heat in a long charcoal fire, and quenched in a bath made of a salted mixture of oils, fats, wax and rosin which is varied in summer and winter. It is essential that the hardening be done thoroughly and uniformly. Scythes were formerly made with a steel edge and iron sides, and they would stay where they were set, for the iron held them there. Suppose the sword was made with an iron center, the effect would be a tendency to remain set like the scythe, and very much in this condition is steel which is not hardened entirely through. That part which is not hardened has a tendency to set and this is detrimental to the elasticity of that which is hardened.

After the swords have been cooled in the composition they are drained and the temper is drawn as the judgment of the temperer dictates. He is guided by the usual heat tests. The burning of his composition on the blade as it is passed backwards and forwards over the fire is carefully observed, and the manner in which it burns is noted. The way in which the blaze catches indicates when the heat has done its proper work, and how perfectly, and also whether it should be stopped by dipping in oil or allowed to gradually die out.

The proper tempering of swords was once a thing of much greater importance than it is now, but the arts learned from war are applied to peace, and when the sword is beaten into the pruning-hook it gets its new temper as it got its old.

Many, if not all, of the swords now made in this country are rolled out, instead of being drawn with the trip-hammer, and this is a very great improvement on the old way. It will be noticed that the work done under the trip-hammer was to draw out, to extend in length, and this is the rightful function of rolls. When any piece of malleable material is to be extended in length of a regular size, or when it is to be extended by a size which gradually increases in width or thickness, or in both, the proper place to perform the operations is undoubtedly between rolls of suitable forms. Where there are bulges, or other irregularities in the piece to be forged, or when there are not enough of a certain shape to be made to warrant the expense of manufacturing rolls for that particular purpose, the trip-hammer has great capabilities, and affords the assistance of a very valuable labor-saving device.

In rolling swords, the processes are naturally conducted in the same order which was carried out in making them by hand, or with the trip-hammer. The shanking can be done with rolls, although for this operation it does not appear that they possess any advantage over the trip-hammer. The rolls for drawing out the blades are similar in form to the engravings, which represent a diametrical section of the upper and lower lop-sided segmental mutilated rolls, the general principle of which is very extensively used at the present day in doing a great variety of work. Fig. 1 shows the segments in engagement, and Fig. 2 shows the interval of disengagement.

The length measured on the periphery of the outlying segments should be twice the length of the longest radius. As the rolls are intended to run at a regular rate of speed, if they are made in this proportion, the segments will be engaged about one-third of the

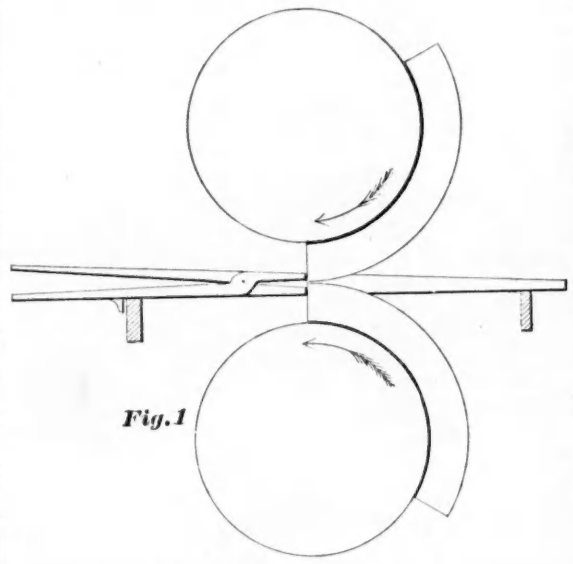


Fig. 1

time occupied in each revolution, and during the remaining two-thirds of the time there occurs an interval, in which the piece to be operated upon can be put in position, ready to receive in its proper place the impression which the rolls are formed to produce. There are gauges in front of the rolls, and rests behind, against which the tongs, which hold the work, are brought by the operator in this interval, and these gauges are so adjusted that, when the work is rested against them, it is in the proper position to receive in the right place the impression of the segments when they come around. These segments, which form the dies, are sometimes made in separate pieces, which can be fastened to the mother rolls, or the rolls may be cast with these parts projecting. Probably it is best to make them in separate pieces; it certainly is for experimental work. A happy combination in unlimited proportions of patience, skill, hard work, and good judgment will produce perfect working rolls. When several persons are working on the rolls together, these requisites should be divided so that each man may have a share of each. It would be manifestly unfair for one man to have all the patience and another all the hard work. Each operation to be performed has a proper conformation of the roll to perform it. To block out the sword, it is passed through the rolls flatwise in one place, and edgewise in another. Another impression is for grooving, and still another for making the oval form at the point. This is as far as the trip-hammer went, and here the rolls leave it.

It seems, upon a close examination of the different effects which the two different modes of manufacture may be held to have produced upon the metal operated upon, that the advantages are altogether in favor of the rolls, for they do not take a small step of the steel at a time, and force its particles to elongate, as is the case with the triphammer; but, on the contrary, each particle of the same kind—as to its relative nearness to the axis or core of the bar—is operated upon in the same manner, and this must tend to produce a uniform structure and disposal of the grain, as far as uniformity of treatment can be made conducive to that desirable result.

The expression, "the steel is crystallized," sometimes conveys only a vague and vapory meaning. When any tool breaks, a scant examination generally suffices for the exclamation, "the steel is crystallized!" Crystals are formed by chemical action. The evaporation of salt water, the cooling of melted antimony, or of iron cast upon a chill, are familiar instances where the forms of crystals are easily distinguishable. It was thought unsafe at one time to fire a cast iron cannon more than a thousand times, on account of the loss of strength caused by crystallization. Reports have been made that car axles become weak from the same cause. One report was that this crystallization started in the axle center, and the plan devised for preventing it was to remove the starting point by boring out the center like a cannon, only letting the hole extend the whole length. A machinist, who made some large screws of disused car axles, found that they were shaky and unfit for use. The turning disclosed a seamy appearance of the iron, indicating a structure like that which can be seen on iron which blacksmiths have repeatedly used during the winter for heating water. In round iron these seams usually run to the center. It is not to be presumed that they would not occur even if the center was bored out.

Changes are made in the structure of iron and steel, by percussion or by any jarring which sets the molecules in motion, which, while they are sometimes very injurious, ought not always to be characterized as crystalline. Allusion has been made in a previous paper to some very close-grained steel that broke with a fracture which resembled that of old, dry cheese, and looked as though the particles adhered together in little chunks, between which there was less cohesion than between the particles of which they were composed. By this it was not intended to be understood that the steel was crystallized. Probably with a broken-faced sledge a blacksmith might produce, by cold hammering a small piece of steel, some such an appearance; and an effect of somewhat the same nature might have been produced on the swords drawn in the manner which has been described, but at the time they were operated on they were brought to a soft, ductile, perhaps, properly speaking, a plastic condition, by the action of heat. The metal in this state works same as a piece of chewing gum when squeezed, the particles elongating and sliding one over another without breaking. When the metal is allowed to cool, its quality of plasticity goes away with its heat, and the thermal point, at which it is so far lost that it is afterwards injurious to work the steel, depends entirely upon the amount of effect produced by each blow that is struck. It is because steel, as it cools, becomes less capable of enduring hammering without injury, that the expert steel workman, in making a fine cutting tool like a steel engraver's burin, lets his blows fall lighter and lighter until, when he stops—at about a sissing heat—they barely touch the steel. Hardening this tool at a subsequent heat, which is scarcely red, and breaking off a bit, he finds the good results of this treatment in a grain so fine that it cannot be distinguished by the unaided eye except by its finely-divided exhibition of the prismatic colors, its iridescence, its rainbow hues.

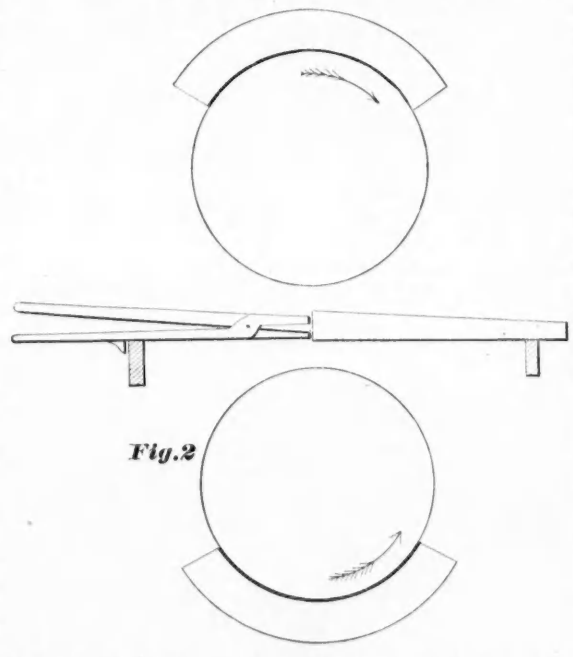


Fig. 2

Malleableized Cast Iron.

Malleable cast iron, or malleable cast iron and steel castings, are castings made originally of ordinary cast iron, which have been subjected to a process of decarbonization, which results in the production of a crude wrought iron. The process is conveniently applicable only to small castings, although pieces of considerable size are sometimes thus treated. Handles, latches, and other similar articles, cheap harness mountings, ploughshares, iron handles for tools, wheels and pinions, and many small parts of machinery are made of malleable cast iron, or as steel castings.

For such pieces, charcoal cast iron of the best quality should be selected, in order to insure the greatest possible purity in the malleable product

The castings are made in the usual way, and are then imbedded in oxide of iron—in the form, usually, of hematite ore—or in peroxide of manganese, and exposed to the temperature of a full red heat for a sufficient length of time to insure the nearly complete removal of the carbon. The process, with large pieces, requires many days.

If the iron is carefully selected, and the decarbonization is thoroughly performed, the castings are nearly as strong, and sometimes hardly less malleable, than fairly good wrought iron, and they can be worked like that metal. They will not weld, however.

The pig-iron should be very free from sulphur and phosphorus The best makers have usually melted the metal in crucibles having a capacity of 50 to 75 pounds (22 to 34 kilogrammes), keeping it carefully covered to exclude cinder and other foreign matter.

The furnace is similar to that of the brass foundry, from 2 to 2½ feet (0.6 to 0.75 meter) square, and the fire is kept up by natural draught. The temperature is determined with sufficient accuracy for the practical purposes of the founder by withdrawing a portion on an iron bar. If hot enough, the drop burns on exposure to the air If right, the metal is poured quickly

The "cementation," or decarbonization, is conducted in cast iron boxes, in which the articles, if small, are packed in alternate layers of the decarbonizing material. As a maximum, about 800 or 1,000 pounds of castings are treated at once. The largest pieces require the longest time. The fire is quickly raised to the maximum temperature, but at the close of the process the furnace is cooled very slowly. The operation requires from three to five days with ordinary small castings, and may take two weeks for large pieces. This process was invented in 1759.

Decarbonization is often performed, in the production of steel castings, by a process of dilution accompanied with, possibly, some "dissociation," By the preceding method the carbon takes oxygen from the surrounding oxides, and passes off as carbon monoxide (carbonic oxide); in the process now referred to the carbon of the cast iron is shared between the latter and the wrought iron mixed with it in the melting pot, and a small portion may possibly pass off oxidized. The latter method has been practiced to some extent for a century.

Selected cast iron and good wrought iron are melted down together in a crucible and cast in moulds like cast iron. The metal thus produced contains a percentage of carbon, which is determined by the proportions

of cast and wrought iron in the mixture. The amount is so small, frequently, that the castings can be forged like wrought iron. The process is properly a steel-making process, and will be considered at greater length when treating of the manufacture of steel.—*Thurston's Materials of Engineering.*

LETTERS FROM PRACTICAL MEN.

Excellent Drill for Flue Sheets.

Editor American Machinist:

About two years ago, owing to an idea which we received from the AMERICAN MACHINIST, we abandoned the drill we were using for flue sheets, which was made in the shape shown in Fig. 1, and tried a drill which is illustrated in Fig. 2. As the change has given us much satisfaction, and has been the means of saving valuable time in doing the work, I will note down a few particulars for the benefit of your readers, some of whom may still be working with the defective tool that we discarded.

In the first place No. 1 cost about twice as much as No. 2, and was not nearly so effective or reliable. In making No. 2 drill it is forged solid with the guiding pin in the center ready for turning down, and the lips are set forward after the fashion of the twist drill. The drill is then turned down in the lathe, the pin to ¾″ and the spread lips to the diameter of the flue to be drilled, which with us is generally 2″ or under. For large flues the entire proportions of the drill would require to be larger. After the drill is turned to the proper size, we file the heel to give the cutting edge enough clearance to cut good, then we are ready to cut the full sized hole round the pin hole, and the work will be done clean and true every time.

There is a distinct difference between the way the drills Nos. 1 and 2 do their work. No. 1 cuts like a parting tool leaving a washer the full thickness of the sheet between the cutters, and when the sheet is a little uneven, or the drill spindle has some lost motion, the drill will drop through and very great care must be taken or the drill will catch and break. But the drill No. 2 acts differently. Its tendency is to clean the whole hole as it goes through, and when it has cut the stock till a thin washer remains, it springs the piece down on the center towards the pin and allows the edges to be cut clean through without danger to tool or sheet. We can drill each hole in locomotive flue sheets in about 2½ minutes with this tool, while our old rig took about five minutes. This gain of time we are in the habit of crediting to the AMERICAN MACHINIST.

A. M. D.

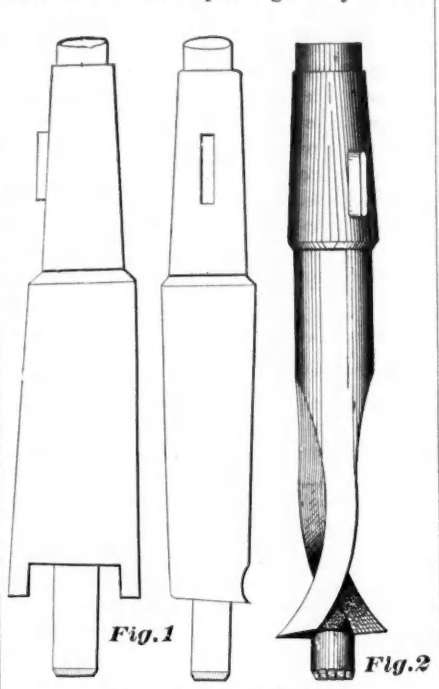
Applying for a Job.—Faults of Lathes.—Screw Cutting.

Editor American Machinist:

I was much interested in Chordal's letter in your issue of June 9. I think it is well worthy the attention of machinists. It is an every-day occurrence for a machinist to come into a shop with the inquiry, "Are you in want of a first-class lathe hand?" or, "Are you hiring any number one vise hands or floor hands?" In my opinion it is much more to the credit of a man to ask for a job at the branch he wishes to work at, and leave the question of his ability to be found out by others. The foreman will very soon determine this, and if he has superior attainments they are sure to be found out and receive due consideration.

A word about tools. During the past twenty-five years many improvements have been made on shapers, planers, milling machines, slotting machines, etc.; but the lathe, the chief of all machine shop tools, has been but very little improved. One of our large machine shops re-stocked their works about twelve years ago with thirty "improved" lathes, and these lathes are in a very poor condition to-day as compared with some of the lathes about twenty-five years old. The most of the fancy adjusting tool parts are made rigid, or dispensed with; the fancy feed is getting out of order, the screw is placed back of the lathe, which makes it more difficult to come at, when, as is sometimes the case, it is desirable to engage or disengage it with the lathe in motion. As it has been my duty to keep these tools in repair, I know whereof I speak.

G. T. E., in your issue of June 16, takes me to task for not explaining the system of



DRILL FOR FLUE SHEETS.

screw cutting. There are plenty of books that aim to do this, but to thoroughly understand it, the common arithmetic and a little common sense are all that are needed. It is simply a matter of proportion between the leading screw and the screw to be cut, and to understand and work it one must be acquainted with fractions and proportion.

MACHINIST.

Duplex Indicator for Lathe Use.

Editor American Machinist:

The engraving, which is half-size, I think will show the construction of an indicator which I have designed for lathe use, which will not only indicate errors in face-plate work, but is equally applicable for work between the centers.

Upon the swivel head or yoke which carries the chuck and rod are two lines quartering to each other, and in a central position with the yoke, while the part that connects the yoke has but one line, in a central position likewise. In the drawing, the instrument is in position for detecting errors in work that is between the centers. When used for this purpose the lines should form one continuous line. This will bring the vibrating rod in a vertical position. The thumb-screw, shown in the plan to the right, should be slightly tightened, to prevent the rod from falling from its vertical position. The point bearing against the work, as shown, should be either slightly above or below the center. This point is hardened and inserted in the chuck. Between the inside of the chuck and yoke is a spring and plunger (not shown), the plunger bearing against the flat side of the chuck for the purpose of bringing the rod back after it is moved forward by the work being out of truth.

When the indicator is used for face-plate work, the thumb-screw should be slacked slightly, so as to permit the yoke to swivel, in combination with the chuck, upon the pointed screws, making as it does an universal joint.

When changing this yoke from one class of work to another, bring the lines to correspond, which in this last instance will bring the rod in a horizontal position. Make the rod ⅜″ diameter, and not less than 26″ long. It should be jointed in the center like a fishing rod. This will allow the rod to be conveniently put away in the tool-chest. From the connection the rod can be tapered, so as to make it light.

C. E. SIMONDS.

Stamford, Conn.

Instructing Master Mechanics.

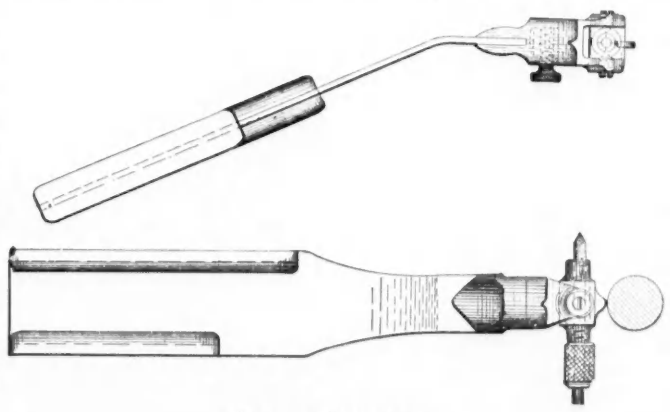
Editor American Machinist:

The Master Mechanics' Association, in pursuing its purpose of widening the knowledge of its members through the mutual interchange of experience, has found it convenient and profitable to receive as associate members certain gentlemen whose technical and scientific acquirements recommend them as likely to be of service to the association. The association has generally been wise in the selection of its associate members, several of whom have from time to time contributed valuable papers, which have been of real service to the members, while they increase the technical value of the annual reports. In scarcely any instance have the papers of associate members been characteristic of bad taste.

An exception to this happened at the last convention, when Mr. F. W. Dean took upon himself, in the course of a paper on locomotives, to lecture the association as if it were composed of schoolboys who were ignorant of the elementary practice of mechanical work. In an association composed of the leading practical mechanics of the day, the men who have made the American locomotive without a peer for general utility, this associate member in a roundabout way informed them that they were densely ignorant of their business, since they did not humbly follow the instructions of English locomotive engineers, whose building practice he proceeded to dilate upon and to show how little, even of that, he knew with any degree of accuracy.

To begin with, this purist objects to mouldings on domes and sand-boxes, alleging that they should be plain, with hemispherical tops, &c. This is a style of beauty which the American artistic eye has not degenerated to, so most of us will continue to prefer our own pleasing outline taken from classic models. But before looks comes utility, and the first purpose of a sand-box top is to keep the water out, and a smooth, hemispherical top cannot be arranged to perform water-tight functions.

Then he objects to our cabs, and tells us that Englishmen use iron cabs. It is not overstating the case, viewed from our standpoint, to say that there is not one respectable locomotive cab of native make in the whole of Britain. The best cabs on the most elaborately-finished English locomotives are away behind the worst that are on our plainest switching engines. And yet this man wishes us to borrow from the people who have not learned how to build a decent



DUPLEX INDICATOR.

cab. No man in his senses who ever rode in a cab in a hot summer day would dream of advocating the use of iron as a material for cabs.

Then he dwells at considerable length, bewailing over the American locomotive as a remarkably wasteful machine, and cites an array of figures to substantiate his position There is nothing easier in the world than making figures lie, and Mr. Dean does not find the process difficult. American locomotives are just as economical of fuel, in proportion to the work they have to perform, as the ordinary run of English engines, Mr. Dean's figures to the contrary notwithstanding. I can take the performance of a selected English locomotive running on a certain division, and make its comparison with a selected American locomotive appear as bad as the case he works out against our engines.

I have had some experience with slab frames which he wishes us to borrow from English practice, and there is no single good point about them, except that they permit a slightly wider fire box. Frames of that kind give no more vertical stiffness than the bar-frame, and they are so flexible to side strains that they allow the whole structure to oscillate, which is a striking weakness of English outside connected locomotives. Then there is difficulty in attaching pedestals substantially, and the numerous bolts about the frame get jolted loose, and the whole thing is an endless source of trouble and annoyance.

He is going to regenerate our boilers entirely, and advocates a long list of radical changes.

I am safe in saying that every change he recommends would, if followed, be a movement in the wrong direction. For the last forty years there have been periodical but harmless agitations against the dome as a point for taking steam from the boiler. The echo from some of these ancient agitations has sounded in the ears of Mr. Dean, and he has felt seized with an original inspiration that called on him to proclaim the cause of the neglected perforated pipe. If any one should listen to his cry and build an engine with a perforated pipe, the man who ran that engine would curse the designer daily from the beginning of his trip to the return to the round-house. And while toiling at his woeful labor of cleaning off the primed jacket the fireman would entertain ungenerous sentiments towards the men who schemed domeless locomotives; and the coal pile would be severely taxed to make enough wet steam to enable the engine to work. In the course of a few months this engine will be taken quietly into the machine shop, and when she gets out, a big dome will be a prominent feature of the boiler. And the master mechanic will keep a big club in his office to use on the next man who comes round wanting him to try a perforated pipe.

Mr. Dean objects to the ordinary guide, because it is open to the dust. If he had much to do with keeping locomotives going he would perceive graver objections to any form that would let dust in and have a tendency to retain it there, as the plan of cast head-guides which he proposes certainly would do. As was proved at the meeting this form of guide cost twice the expense of bar guides, and I am greatly mistaken if the cost of maintenance does not prove fourfold as great.

His plan of tubular side-rods is an untried novelty which does not possess the first element of success. A tubular rod would give greater strength with less material, but the practical difficulties of fitting out such a rod are insurmountable.

Of course, Mr. Dean recommends the Joy valve-gear, for it is English. His description of its merits as a device for distributing steam is drawn mainly from a fertile imagination. It possesses no advantage over the link, except that of dispensing with the eccentrics on the driving axle. It is not being rapidly adopted in England or anywhere. That it lacks popularity is proved by the small number of locomotive builders who have been prevailed upon to use the motion, although its light has not shone under a bushel.

Viewing Mr. Dean's paper from any other standpoint that can be conceived, it is hard to find an original or useful point about it. Why such a paper should claim the right to occupy the attention of such a body no one can find out. The next time Mr. Dean feels constrained to instruct master mechanics he had better select some subject that he himself knows something about, and one on which his audience is not quite so familiarly versed.

MASTER MECHANIC.

Quick-Motioned Planers.—A 16-Inch Lathe that will Turn.—A Tool Post that is Adjustable.—Handy Boring Tool.—Unsympathetic Workmen.

Editor American Machinist:

There are probably certain things that please all men. All good workmen are likely pleased at a good job of work in their own line—particularly if they do it themselves—and all employers are pleased to see a job done quickly, whoever does it. There were two things that pleased me at the Chicago Exhibition—Miles' planing machine, which would take a cut, stop, turn around, go back and get ready for another cut twice in the same day. I think it must have made many an old railroad hand groan to see it do it, but I really enjoyed it. Think of a planer bed weighing nearly a ton, with a load of a ton and a half on its back, dancing around at the rate of five times the regular speed! It would just kick the dust off Lydia Thompson's heels in her best days, and it seemed to do it, too, without laying a hair. Some doubt if the planer will stand it. It does stand it, and it's going to stand it for a while. I think it will pay for itself in moral effect before it is worn out.

Another thing that pleased me was the way Bullard's 16″ lathe took hold of a piece of round iron. Talk about business, when a 16″ lathe will take a 5″ round bar of cast iron, and with a coarse feed rip it down an inch and a half at one cut, as the Bridgeport lathe did at the Exhibition. It seems to me this was something that ought to make a common lathesman turn a somersault. But it didn't; and it didn't for this reason: The lathesman could see for himself that the same lathe could be made to cut $\frac{1}{8}$ of an inch or $\frac{1}{16}$ of an inch just as readily. The common lathesman can see just as well as you or I, Mr. Editor, that a lathe can be made to go six or eight times over a piece to get it down a certain amount, even if it is capable of doing it at a single cut. So what does all this heavy trussed bed, solid head-stock, big spindle business amount to when it don't get a half hitch on the lathesman, and entice him to screw in the tool?

I want to say one thing, by way of parenthesis, and that is about these strong lathes. None are stronger than their weakest part, and the weakest part in a good many of them is the tool-post. The Lipe patent tool-post on the Bridgeport lathe has more business in it than any other I have seen. The tool can be set on the left or face-plate side, in the center, or on the right side, and made fast there. It can be quickly raised, however, or rotated on the vertical stem either way, and bound fast with a single twist of the wrench. When it is clamped it is fixed to stay, and is as rigid as the lathe itself. This tool-post also embraces means for holding any size of octagon steel for boring tools, the value of which few appreciate.

With a boring tool of the kind shown in the annexed cut, steel very nearly of the size of the hole to be bored can be used, and the tool may project from the holder only the distance required. But, as I was remarking about screwing in the tool, there is nothing about the tool-post that will compel the lathesman to use as large a tool as he can—when he has any little ones on his tool board—and there is where Miles is going to get left on his planer. The blamed thing will go back so quick that it won't give the ordinary planer hand time to smoke. It takes the thing out of his hands, so to speak, and he won't have it. E. D. S.

Melting Iron with Coke.

Editor American Machinist:

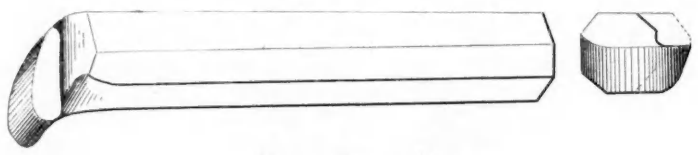
I have noticed several communications in your recent issues about melting iron with coke, and have incidentally heard of several failures to use coke satisfactorily. There is no great secret in using coke, in fact much greater skill is required to melt with anthracite coal.

I think much of the lack of success at first is due to the spongy character of coke when ignited, as compared with anthracite coal. Coke is very compressible when ignited, and the bed should be from 20″ to 22″ above the tuyeres before charging.

The lighting off should be so timed that it will light the coke-bed just sufficient to be red around the lining, and live coke be seen in all the tuyeres; then put 1½ lbs. of iron to 1 lb. of coke on the bed for the first charge of iron. The next is a charge of coke, which should be about 4″ deep, then put on 4″ depth of iron and again 4″ of coke and 4″ more of iron, and so continue. Should the iron come dull, use more coke at the next charge. Should the iron come slow and hot, reduce the charge of coke. Here is where "you can regulate melting with coke that cannot be done with anthracite coal, as the charges of iron are so heavy with the latter that you cannot alter it after charging up."

You can have too much wind in a cupola, for either coke or coal, that is too much to melt economically. Coke requires less wind than coal, but where the wind is in excess in either case the melting point is varied, as complete combustion takes place higher.

It is impossible to give definite instructions for melting in every cupola, as the varying conditions will call for varying management.



Handy Boring Tool.

The foregoing instructions are such as will give good results in the majority of instances, and deviations from them can be made, not going to extremes, until it is found what best suits any special cupola and the conditions under which the melting must be done. With considerable experience in melting with coke in different cupolas, I have always found it safe to start with a strange one as indicated. I have invariably found upon inquiry of those who had trouble with coke that they made their charges of iron too heavy, and did not keep their bed up to an even and regular height by short charges of fuel and stock. Foundryman.

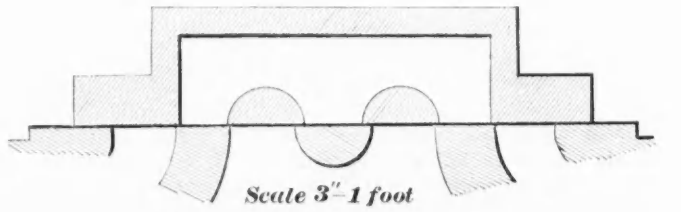
Another Peculiar Valve Construction.

Editor American Machinist:

I inclose a sketch of a valve taken from an engine 16″×26″ driving a planing mill. The ports were 12″ long, and with 70 lbs. steam pressure, and 80 revolutions per minute, only 56 horse-power could be developed. The engine pounded badly, and the "doctors" who had been called in to examine it advised that a new pillow block would cure it.

It will be seen that the exhaust begins to close when the steam edge begins to open the port, and that by the time the steam port is fully opened the exhaust is very nearly closed. When the travel was shortened the engine run much better, still, looking to the valve for the trouble was never thought of.

H. M.



Peculiar Valve Construction.

Time Keeping.

Editor American Machinist:

"Chordal" gives some hints on time keeping. I will give you my method, a method I have adopted after five years' trial of other methods. Enclosed please find time-card, a copy of one filled up by a workman for a day's work.

TIME CARD *of Thos. R. Marston, For 5th day of July, 1883.*

Boring 2 Brass Boxes for Kuestner & Co.	2	¼
Drilling 4 bolt holes " " "	....	¼
4 Bolts and Nuts ⅝×2½	....	..
Repairing Cam for Wrigley & Bros. (Not finished.)	7	¾
	10	¼

I have these printed and tableted, about 50 in a tablet, one of which is given to each workman, who writes down immediately a job is finished, the name, job, whom it is for, and the time of each operation he was doing to said job.

This card is laid on the book-keeper's desk as the workman leaves work in the evening, and is entered up next morning, either charged in day-book, if a small job, or entered up in cost book if a large job not finished. This relieves the foreman of all trouble as regards keeping time, except to see that the proper names are given to the work being done.

These cards are filed away for each month, and are very useful in case of dispute between the party ordering work and proprietors of machine shop. Lewis G. Carr.

Fitting Up Crank Shafts.

Editor American Machinist:

Having noticed with much interest the various suggestions on machine shop appliances in your valuable paper, I would offer one on properly putting the pin in the disc of a crank shaft—one of the most vital points in steam engine building.

Seeing one from Prof. John E. Sweet of the 7th inst., causes me to believe ours is the best means to obtain the most successful mechanical results, permitting the use of a much smaller lathe and cheaper attachments, besides having each individual part true, independent of the other.

To commence, we turn the shaft throughout and finish to size. Have the disc bored and roughed out to within $\frac{1}{32}$″ on an arbor. Shrink the disc on shaft and finish turning and polishing the same by carrying most weight in steady rest, (we approve of balancing a disc by placing the balance weight close as possible to it, instead of on the face plate, as is generally done). When finished put an attachment somewhat similar to Prof. Sweet's boring bar attachment (but which may be smaller, not having the shaft hole to bore) on the rest in place of the tool-post, having its centers perfectly parallel and same height with lathe centers. Swing the disc into position for height, and clamp firmly. The boring tool may be adjusted for distance from center by the rest. We have the advantage by this method of the use of the live spindle to operate the screw, thereby carrying the rest along while the hole is being bored.

I hope for further discussion on this important subject.

R. H.

The Old and the New Apprentice Systems.

Editor American Machinist:

I regard the question of a proper apprentice system, which you from time to time present to your readers, as of the utmost importance to both the employer and employe, and the benefits to be derived from a thorough understanding and solution of the question as of general good to the nation.

In your issue of June 23 appears a communication on this subject from F. J. Masten, in which a few of the minor causes which brought about the death of the old system are plainly stated. I agree with Mr. Masten that "in forming a new system it may be well to bear in mind the cause of death in the old;" but I cannot endorse the statement that "the late apprentice system died of starvation pure and simple," although I admit that the starving process had the effect of deterring many boys from being indentured to a trade, to be worked and starved for a period of seven years. Strange to say, those apprentices who underwent this starving process, and endured to the end, generally turned out to be the most penurious and avaricious of journeymen, and, with few exceptions, the most tyrannical and exacting of employers.

The old system of apprenticeship died with the old system of manufacture, of which it was the outcome; and wherever you find the old processes of manufacture carried on to-day, there you will find the apprentice system, modified to suit particular localities and conditions. Just as labor-saving machinery enters in as a factor to change the process, so will you find the agreement between the master and the apprentice modified to suit the change.

These changed conditions are taking place even in trades where machinery cannot be introduced, as, for instance, in the plumbing business.

In localities where iron and lead pipe are used, a plumber is required to be a pipe-fitter also, and in some localities where galvanized iron pipe is run there are but few plumbers of the old school employed, as they are seldom required to wipe a joint, make a soil pipe or trap, or line a sink or tank. When lead pipe was exclusively used, a plumber was in a measure a manufacturer, as he had to make lead pipe and traps of large sizes, and many articles used in his trade. The apprentice was generally required to be a very bright, sharp boy, who could attend to the solder pot, tin the irons, prepare the acids, etc., and be gradually advanced step by step until he could wipe a joint, cut, form, and unite a soil trap, line a sink, take measure of buildings to be piped and fitted, and other important requirements of the trade. To procure and retain such an apprentice the master was forced to enter into an agreement with his parents or guardian to learn him the trade in all its branches, and either to pay him fixed wages, or to board, lodge, and clothe him until he arrived at the age of twenty-one. By such an agreement the boy learned a good trade, and the master received in return the labor of the boy, which for the average skill and labor expended was a fair equivalent for the benefits received by the boy.

All this has undergone a change, because of the fact that a general knowledge is not required except in special cases, nearly all the material used being manufactured outside of the trade; therefore, if a boy leaves before he is 21 his place can be filled by a jack leg from another shop who has failed to fully learn his trade.

Under the old system the apprentices to the machinist's trade were taught to forge and temper the tools they used, which consisted of a set of round-nosed heel tools, round-nosed flats, square points, square point flats, right and left side tools, cutting-off tools, inside and outside chasers, &c. To make these tools and use them with skill and dexterity required a long period of close application and practice. Each apprentice learned the system peculiar to the shop in which he worked and its proprietor, and became in a measure part of the concern. To turn a shaft true with a heel tool, to chase a true male thread and fit it to a female thread, to get under the skin of a very rough casting or forging and produce a true bright finish with the hand tools mentioned, required a degree of skill, patience and practice that would frighten an apprentice of the present day so that he would never learn a trade. Under such a system it required a binding agreement between master and man, as both had concessions to make and both advantages to gain.

Thus, we see that as the old system of manufacture becomes displaced by the new, so also must the old system of apprenticeship disappear and a new one be introduced to meet the changed conditions. To say that we must return to the old system of appren-

ticeship is as absurd as to say that we should substitute the old heel tool in turning for the self-acting slide-rest lathe as at present in use.

Under the modern system of manufacture mechanical, chemical and scientific discoveries have been introduced to aid the muscle, the laws of evolution being as actively at work in mechanics as in nature, all tending to selection and perfection, and having for their ultimate aim the production of the greatest quantity and of the best quality in the least possible time, with the least expenditure of physical and mental energy. In order to bring about a more perfect system of manufacture the workmen must be selected —just as the materials are selected for a machine, with a view to their fitness for the parts assigned to each to perform; therefore, I say that, in order to introduce an apprenticeship system to meet our present and future requirements, trades will have to be renamed and the workmen classified and assigned according to their natural or acquired ability for certain branches.

For instance, I hold in my hand a perfect piece of forging requiring but the brush of a revolving wheel to polish to perfection. By what name shall I call the man who forged it? He is not a "whitesmith" nor a "blacksmith," because neither of those tradesmen could duplicate it. The piece is known as a drop forging, and should not the man who forged it be known as a "drop forger?"

The drop forger does not possess the varied skill and experience of the whitesmith or blacksmith, yet the task assigned him is of more importance. It involves the setting and caring for his dies and press, and the manipulation of his stock to the best advantage, all of which requires a cool head and steady nerve.

Under the present system of interchangeable parts, where each part is assigned to the men selected for their ability to produce the best results, should not the men be designated by names associated with the tools they use: for instance, lathemen, planermen, drill-pressmen, vise or benchmen, screw makers, tool makers, etc.? If the workmen were thus classified, an apprentice could be taken on trial for a few months, and given the run of the shop and tools. He could then be assigned to the branch best suited to his taste and ability. The result would be that, through constant application to one branch, he would become proficient, as his mind would be free from complicated details, which it is clearly the duty of the foreman to assume. Thus a perfect planer hand could demand and receive as high wages as if he went through the form of learning all the branches, when in reality he was perfect in none.

Under this system there would be no need to enter an apprentice before the age of eighteen or nineteen, as at that age he could reason and plan, and soon be profitable to his employer, who, to retain his services, could advance his wages according to his skill. When the time of service as apprentice was up, a committee, consisting of a journeyman, the foreman in his department, and his employer, should pass upon and decide the degree of skill and ability he possessed, and should issue to him a diploma or certificate, stating the length of time served and class of work, and other details, if required. With such a diploma he could procure work at his branch of the trade wherever a vacancy occurred.

Out of the number of apprentices entered on trial, there would be some who could acquire a sufficient knowledge of all the branches of the trade to fit them for instructors, directors or foremen, as some possess the ability to direct or instruct, while others possess the ability to execute. In this way the very best results could be obtained, and a marked degree of efficiency would soon be apparent in the quality and quantity of the product. The employer could afford to pay higher wages, the men would be better satisfied than at present, as their minds would be freed from general details, and they would be more inclined to remain in one shop.

To the present learn-all and know-nothing system I attribute the roving habits of the average journeyman machinist. There is no shop in which he is known so well as the one in which he has learned his trade; if he does not fit the place, he takes a walk, only to find that no matter where he goes he is still a learner.

There are many details that will suggest themselves to improve and amplify this system when once introduced. That the present system of manufacture requires an apprentice system to conform to the changes in the various methods and tools employed, no one who has given this subject a thought can question. Hence I claim that the death of the old system of apprenticeship was caused by the death of the system of manufacture which created it.

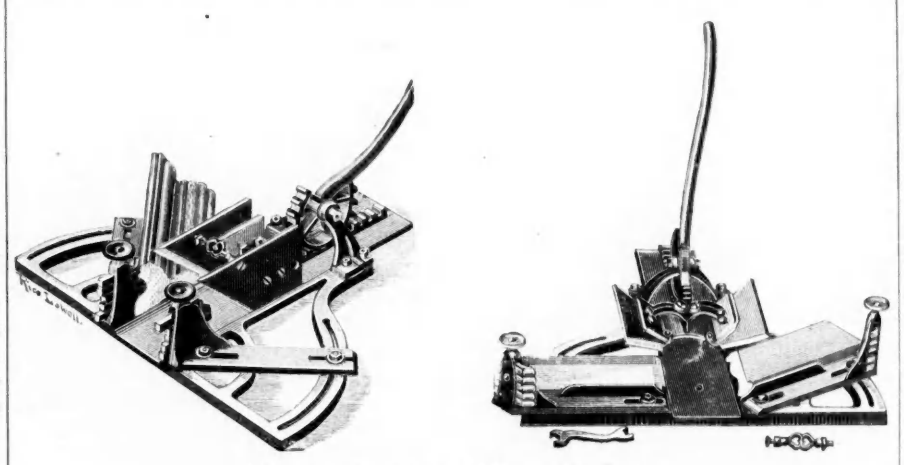
T. F. Hagerty.

San Francisco, Cal.

The Howard Adjustable Miter Machine.

The machine, which is represented by annexed figures, is a convenient device designed for cutting miter joints in such articles as picture frames, the finish around doors and windows, and similar work. The demand for the tool proves that it is being found very useful among carpenters, cabinetmakers, pattern makers and other classes of woodworkers.

It is made wholly of iron and steel, is as light as is consistent with strength and durability, and has been much improved by the addition of adjustable back rests, which are



Howard Adjustable Miter Machine.

easily and quickly adjusted to irregularities in the back of the picture frame and other mouldings. This avoids the tendency to slip back while being cut, and renders it a very complete machine.

It has a semi-circular bed with cutter-head sliding in grooves through the center, which is operated by means of a toothed lever held between uprights over the slide and works in a rack on its top, by means of which the cutters are forced through the stock to be cut. As the machine is adjustable in all its parts, the back-rests being adjustable from 5° to 90° with cutter-head and the cutters from 45° to 90° with bed, it will readily be seen that it may be adapted to a wide variety of work.

The large machine is intended to cut stock 1″ thick by 11″ wide, or mouldings 4″ high. The cutters are set at right angles with the bed and the adjustable back rests at an angle of 45° with cutter head, which is the proper position for cutting picture frame mouldings, &c.

The machine is represented in two different positions, which will serve more fully to illustrate its adjustability. It will be noticed that the back rests are reversed, bringing the beveled ends towards the cutters, so that they may pass over them when brought down to an angle of 45° with bed. One side of the machine is adjusted with back rest at an angle of 90° with cutter head and cutter at an angle of 45° with bed, and is shown as mitering door-sides, while on the other side the back rest and cutter are brought to the proper positions for mitering cornice or "sprung" mouldings. These machines are made by F. A. Howard, Belfast, Maine.

The Chicago, Burlington and Quincy Machine Shops.

By Angus Sinclair.

One day while the Exposition at Chicago was in progress, accompanied by several gentlemen interested in mechanical work, I went to Aurora, Ills., for the purpose of inspecting the principal machine shops of the C. B. & Q. Railroad which were reported to be well worthy of a visit. The various shops and offices occupy a space of ground in the form of a parallelogram about three quarters of a mile long. The transferring of material from one shop to another is effected by conveniently arranged transfers and carrying trucks, care being taken to prevent the handling of material unnecessarily in its progress from the rough iron or lumber to its finished product.

In the excellently arranged offices we were introduced to Mr. G. W. Rhodes, superintendent of motive power, who extended every courtesy in letting us examine everything of interest about the works. Round the office of the superintendent of motive power are arranged cases showing the condition of all the locomotives on the road, by a plan followed by the Pennsylvania and several other roads. Opposite the number of the engine is a colored strip of paper which indicates its condition. Thus, white is good order; light blue means, the engine needs light repairs; dark blue announces that heavy repairs are needed; black is the sign for renewal, and red tells that the engine is in the shop. These slips are altered every month according to data received from the various division master mechanic's reports, and supply a convenient and ready means of telling the condition of each locomotive without turning up records. The division master mechanic's report is made on a printed form and enumerates all parts of the engine, and the condition of each part is separately reported upon, which furnishes a most complete record regarding each engine.

Connected with the shops Mr. Rhodes is fitting out a laboratory for testing and examining material to be used in construction and in the operating department. There is a machine capable of making all tensile tests on wood and iron, and apparatus for ascertaining the calorific value of coal and all the plant for testing the qualities of oils and other lubricants. Besides having these appliances there is the more important factor of a man competent to handle them whose business it is to look after the tests.

This railroad company has about 500 locomotives in service, the greater part of the repairing work being done at the Aurora shops. They also have facilities for making a new engine every month besides carrying on their other business. The engines are divided into three classes, A, B and E, and for each class there is a complete set of templates, to which all the work is done. They find the template system valuable, not only in facilitating the putting together of new work, but it proves of immense service for saving time in repair work. As an illustration of this the master mechanic related a case where two engines, class B and E, came together, and each had one cylinder knocked off. Business was rushing on the road, and they were short of engines, so they took two cylinders that had been got ready for new engines, put them on those that were disabled, and had them ready to go out in eighteen hours.

Although in ordinary circumstances the C. B. & Q. shops do not turn out more than one new locomotive a month, their facilities are so elastic that they can, without much effort, rise to the means of turning out one each week.

The templates are applied to every part of the locomotive. All the fire boxes and boilers have every hole located by this means, and the work comes out so accurately that an old fire-box will be taken out and a new one put in without the necessity for drilling a new hole. All the fittings for pipes and every boiler connection are prepared ahead, and no measurements are needed to get lengths for setting up the fittings.

When castings come in from the foundry, whatever may be their dimensions, be it a brake head or a cylinder, they are all drilled or fitted up according to the template measurement and laid away for future use. So, when an engine comes in with a front end knocked in, a stack minus its top, or a rocker box broken, each and every one of these articles will be found ready to put on and the engine need not lose a trip waiting for the work to be done. The same rule applies to every portion of the motion, frame and running gear. The advantage of such a system for carrying on repair work, can only be appreciated by those who have had to get damaged engines ready in a hurry, where nothing was prepared ahead.

At these shops the policy is pursued of doing everything within the works that can be done at a price not to exceed that charged by manufacturers. They make their own wheels, and are satisfied that they get better material than what they could buy in the market. All scrap is worked up by ponderous steam hammers into axles, frames, rods, and other details of engine structure. Springs they buy, having found that it is the cheapest plan.

A correspondent would be pleased if some of our readers would give him information about making cast-iron lathe tools. He would like to know about the chills, and the best shape for the tools, if they can be used for boring tools, and any other information regarding their use.

Says the *Mexican Financier:* "There are fortunes alone in the working-over of the vast amount of waste on the dumps at hundreds of Mexican mines, from which the metal has been only carelessly extracted, and from which rich returns may be gathered by the application of the skilled processes available by modern methods.

As a result of the abolition of the revenue tax on matches, taking effect July 1st, the leading match companies have issued a circular reducing the price of the common brimstone match from $2 00 a gross down to 85 cts., or 75 cts. in 100 gross lots.

Stationary Engineers.

A. M. Davy, 175 Elmwood Avenue, Detroit, Mich., Secretary of the National Association of Stationary Engineers, informs us that the membership of that organization, July 1st. last was as follows: Chicago, 248; Philadelphia, 113; Chester, Pa., 19; Meriden, Conn., 13; Denver, Col., 14; Carthage, Mo, 15; Canton, Ohio, 19; San Francisco, Cal., 24; Louisville, Ky., 20; Wilmington, Del., 27; Detroit, Mich., 32; New Haven, Conn., 34; New York City, 68; Brooklyn, N. Y., 73; Baltimore, Md., 50; Providence, R. I., 82; St. Paul, Minn., 25; Owosso, Mich., 11; Rome, N. Y., 11; Grand Lodge of Mass., reports Boston, Lynn, Worcester and Hamden, 132. Total, 1030.

During the last quarter, 5 associations were chartered, 200 members admitted, 9 suspended, 3 expelled, 12 applicants rejected. The "Mutual Aid" will begin on August 1st, one hundred members having made request to that effect..

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☞ *Every correspondent, in order to insure attention, should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

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NEW YORK, AUGUST 4, 1883.

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Some Effects of Prejudice.

If manufacturers could get a saving clause inserted in a contract for machines that should make clear exactly the kind of treatment they would receive after they left their hands, it would sometimes be of more value to them than the price they received for them. That machinery is ruined by improper care—or for want of ordinary care—does not matter much to them, but the fact that their reputation is frequently unjustly injured by such causes is a matter of considerable importance. Whether machines are properly set, lubricated properly, or with the cheapest oil that can be bought; whether they are handled with reasonable care or knocked about any way; whether they are kept respectably clean or run in an accumulation of grease and dirt; all these things, and a good many others, that are supposed to make no difference to the builder after the sale is effected, really do often make a good deal of difference to him so far as future sales are concerned. More than one manufacturer's business has been impaired by customers who bought at good prices, and promptly paid for what they bought.

Much of the unaccountable prejudice found to exist in certain localities against a generally popular machine—a steam engine, for instance—could frequently be traced to an instance or two of reckless use, or of absolute ignorance in regard to requirements, but prejudice is so hard a matter to deal with that it is not always worth the while to trace it out in the hope of making reasonable headway against it.

We have in mind an instance in which an automatic steam engine, the first of its kind in the locality, and manufactured some distance away, was bought and set up by local talent. The engine was well set on a good foundation, but upon starting it was found that less than one-half the contemplated load was more than the engine would drive at regular speed.

The work being done in connection with the engine represented a new enterprise in the place, and it is safe to say that some hundreds more or less interested in mechanical matters were attracted during the first week to witness the operations, and, of course, all heard that the engine was a failure.

After about two weeks' useless attempts to get something like a reasonable amount of work from the engine, it occurred to the proprietors, as a matter of curiosity, if not of interest, to find out why their motive power was a failure; so further talent was employed to investigate, the result being that the exhaust valves were found in a condition that left the only wonder that the engine would turn over at all.

It may be remarked that in locating the engine the exhaust pipe was led into the sewer; also that the exhaust valves were not readily come at, and the exhaust valve-motion was by the peculiarities of construction in a measure hidden from view. However, it was the work of only a few minutes to set the valves correctly, when with all work on, the engine moved off quite right, and was found to be just about half loaded. This might be supposed to have set matters straight, which it did so far as the owners were concerned, but a good many people knew all about the failure, and few troubled themselves with the cause, beyond the first erroneous impressions. To clinch the matter, so far as unfavorable impressions were concerned, the cylinder, full of water, was allowed to freeze two months later, when it was replaced by another, which required a modification of the valve motion, and as a matter of fact, although the type of engine referred to has had an extended sale elsewhere, there is not (and the case noted occurred fifteen years ago) an engine of the kind in use, amongst some hundreds, in that place to-day.

Here was an instance where a prejudice unquestionably led to a loss of trade, yet whose business but that of the buyer was it that ignorance and carelessness created the prejudice?

Another instance was that of a machine bought for use in a new shop, where the builder had reasonable expectations of placing several more of the same kind, as well as different machines and machinery. The machine was put to work, and failing to give satisfaction, an order for ten others was countermanded and given elsewhere. When the new machines arrived and were put into use, it was found that a weak floor was the chief cause of trouble, and upon taking measures to remedy this, it was acknowledged that the first machine was the best, and that if it had been reasonably dealt with the order that was countermanded would have been allowed to stand. Was the buyer to blame for loss of business to the builder, or did the builder show lack of judgment in selling where the sale would prove the reverse of a profitable advertisement?

Such instances might be multiplied were it necessary, but these are sufficient to show that the builder has many things to contend with besides providing for building good machinery, one and not the least of which is a prejudice born of something for which he is not responsible. It is difficult to suggest a remedy against something as unreasoning as prejudice is, and quite as difficult to indicate how careless and ignorant handling shall not create unfavorable prejudices. The instance of the builder who guaranteed the power of his engines according to the horses—fifty Jersey or thirty Pennsylvania horse-power—only represents an effort at protection from one species of difficulty.

In a thoroughly established business these matters will generally take care of themselves, because wide-spread reputation will overcome local prejudice, but in the instance of a new business, or in the case of something possessing the characteristic of novelty, prejudice often has the best of it. In the introduction of things of real merit, discouragement has often succeeded the effort to overcome the faults of those who ought to have used them successfully.

The latest engineering scheme of striking magnitude is the construction of a tunnel between Scotland and Ireland. It is proposed to drill a tunnel through the basaltic rock from Fingal's Cave, Isle of Staffa, to the Giant's Causeway, in Ireland, the distance being twenty-six miles. That the scheme is practicable there is no reason to doubt, and the basaltic rocks would provide substantial walls to the tunnel, but the expense of cutting through that adamantine rock would foot up a steep bill.

Through the mistake of a telegraph operator, a terrible collision happened a few days ago on the New York and New England Railroad A passenger and construction train came together on a curve, with the result of serious loss of life and great damage to property. An extraordinary feature of the collision was that the boiler of one of the locomotives exploded, scattering death and destruction around. It often has been a matter of surprise, to parties interested in boilers, how the boilers of locomotives withstood the tremendous shock incident to a violent collision, but in no previous instance has a locomotive boiler been known to blow up from this cause.

Ancient Tools.

A paper that was recently read before a scientific association in England, gives some interesting particulars about tools used by the artizans who worked on the ancient buildings of Egypt, and other moribund civilizations. The subject proved specially valuable in showing how skilled artizans performed their work 4,000 years ago. The great structures whose ruins are scattered all over North Africa and Asia Minor, demonstrate that great artizan and engineering skill must have been exercised in their construction, but when parties interested in mechanical manipulations tried to find out something about the ancient methods of doing work, they were always answered by vague platitudes about lost arts and stupendous mechanical powers which have passed into oblivion. A veil of mystery has always been found a convenient covering for a subject that was not understood. The average literary traveler who helped to make up the tons of books that have been written about Oriental ruins, had not the penetration or the trained skill to reason from the character and marks on work what kind of a tool was employed in fashioning it.

A trained mechanic, Flanders Petrie, happened round Egypt lately, and his common-sense observations and deductions have elucidated many of the mysteries that hung round the tools and methods of ancient workmen. From a careful collection of half finished articles with the tool marks fresh upon them—and in that dry climate there seems to be no decay in a period of four thousand years—he proves very conclusively that the hard diorite, basalt and granite, were cut with jewel-pointed tools used in the form of straight and circular saws, solid and tubular drills and graving tools, while the softer stones were picked and brought to true planes by face-plates.

That circular saws were used the proof is quite conclusive, for the recurring, cut circular marks are as distinctly seen on these imperishable stones, as are the saw marks from a newly cut pine plank. This proof of the existence of ancient circular saws is curious, for that form of saw is popularly believed to be of quite modern invention. That another device supposed to be of recent origin was in common use among Pharaoh's workmen is proved by the same authority. We have met several machinists who asserted that they made the first face-plate that ever was used in a machine shop, and we have read of several other parties who made the same claims, all within this century. Now this practical antiquary has gone to Egypt and reported that he found the ochre marks on stones made by face plates that were used by these old-time workmen to bring the surfaces true.

As steel was not in use in these days the cutting points for tools must have been made of diamond or other hard amorphous stone set in a metallic base. The varied forms of specimens of work done show that the principal cutting tools used were long, straight saws, circular disc saws, solid drills, tubular drills, hand grainers, and lathe cutters, all of these being made on the principle of jewel points, while metallic picks, hammers and chisels were applied where suitable. Many of the tools must have possessed intense rigidity and durability, for fragments of work were shown where the cutting was done very rapidly, one tool sinking into hard granite $\frac{1}{16}$" at each revolution. A curiosity in the manner of constructing tubular drills might be worthy of the attention of modern makers of mining machinery. The Egyptians not only set cutting jewels round the edge of the drill tube, as in modern crown drills, but they set them in the sides of the tube both inside and outside. By this means the hole was continually reamed larger by the tool, and the cone turned turned down smaller as the cutting proceeded, giving the means of withdrawing the tool more readily.

As indications on the work prove that great pressure must have been required to keep the tools cutting the deep grooves they made at every sweep, the inference is, that tools which could stand the hard service they were subjected to, must have been marvelously well made. Our modern tool makers give employment to a high degree of mechanical skill, and extended metallurgical knowledge is requisite for the selection of material to make first-class tools. But when we reflect on the difficulties these ancient tool makers had to surmount, in fastening and retaining stones as cutters on a base of bronze, we can appreciate the perfection their art reached. They probably followed methods of hardening copper alloys which are not known to us and are not discovered by modern metal workers, because the knowledge is not essential, but the real mystery of how clean cutting of hard substances was done in those times, lay in the acquired skill of the tool makers.

The Cunard Steamship Aurania.

The decision of the owners regarding this vessel is to fix up the high pressure cylinder so that the low pressure cylinders shall take the steam direct to run the ship home. They expect that by working in this way the engines will be able to maintain a speed of twelve miles an hour all the way across. Slater & Reid, New York, have been awarded the contract to make the necessary repairs, and they guarantee to finish within two weeks.

Literary Notes.

The *Sanitary Engineer*, Vol. VII., Dec. 7, 1882, to May 31, 1883.

The bound volume of this standard weekly publication between the dates mentioned is now ready for issue from the office, 96 Fulton street, New York. The *Sanitary Engineer* is exactly what its name implies—a paper devoted to drainage, water supply, ventilation, heating, light, and other matters connected with the public health, and the bound volumes are an excellent addition to the library of anyone interested in such matters. Amongst the contents of the present volume we notice "Letters to a Young Architect," by Dr. J. S. Billings, U. S. A.; "Steam Fitting and Steam Heating," illustrated; "The Steam Heating Companies in New York," with illustrations; a series of articles on "The New York Water Supply;" a description of "Gas Fitting in an Office Building;" "American Practice in Warming Buildings," by the late Robert Briggs; a series of articles on "Malaria," by Geo. M. Steenberg, surgeon in the U. S. Army, and numerous carefully prepared articles on a variety of subjects of general interest, such as food adulteration, mortality table of the principal cities in the United States with health notes, electric lighting matters and the wiring of buildings, answers to a great variety of practical questions on plumbing, heating, water supply, steam fitting, &c., &c. Price, $2; postage, 40 cents.

Quite a number of contributors to the *Locomotive Engineers' Monthly Journal* are advocating that it should be changed to a weekly. Meanwhile, a large proportion of the monthly is filled with poorly selected matter. The boys of the throttle had better fill up all their monthly with original practical matter before they venture into the expense and labor of a weekly class paper. With the increasing intelligence and practical interest in their work, locomotive engineers should have no difficulty in producing articles relating to their own calling, and advocating their own interests sufficient to crowd out the selections that continue to be a prominent feature of their monthly journal. But the proposal to start upon the work of getting out a weekly journal, means entering into a much greater enterprise than most of the men who advocate the thing realize. The grand officers are already worked beyond ordinary capacity, and the publishing of a weekly would require constant work from three or four additional men. Consequently, the capability of a weekly to pay expenses would be doubtful.

Questions & Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(255) M. R., Freemansburg, Pa., asks: How can I bronze small castings? *A.*—See answer to question 182, issue of May 19, 1881.

(256) W. C. F., San Francisco, Cal., asks: What is used to lacquer small articles after they are plated with gold and copper? *A.*—Gold plating does not require lacquering. See answer to question 172, May 12, 1883.

(257) Constant Reader, Auburn, N. Y., wishes to know what is the largest engine ever built, and how many horse-power. *A.*—The largest engine we know of is being put into the Guion Line's steamer Oregon. It is 12,000 horse-power. The engines of the City of Rome, belonging to the Anchor Line, indicate 10,000 horse-power.

(258) F. A. B., Jersey City, N. J., asks: 1. How shall I find the area and the cubical contents of a round ball? *A.*—To find the area, or convex surface, multiply the circumference by the diameter. To find the volume, multiply the cube of the diameter by the decimal number .5236. 2. Please give me points as to the use of a tram on an engine. *A.*—See AMERICAN MACHINIST of Sept. 2, 1882.

(259) B. S. C., Brockville, Ont., writes: I have a yacht engine 4½"x4½". How should the valve be set, and what should be the size of steam and exhaust pipe? *A.*—We could not tell how to set the valve without further particulars. Generally, if the valve is set so that the steam port just commences to open when the crank is on the dead center, it will be right. Steam pipe, 1¼"; exhaust pipe, 1½".

(260) M. H., Jackson, Mich., asks: 1. Is a steam gauge light or heavy when it shows 10 lbs. with no steam on, and how will it be at 50 lbs.? *A.*—We should say it was light at 10 lbs., but cannot say how it will be at 50 lbs. 2. How can I change a valve cutting-off at 15" so it will cut off at 10", and how can I set a cut-off valve on a common engine? *A.*—Neither of these questions could be answered without knowing all the particulars of the valve motion.

(261) J. A. O. D., Detroit, Mich., sends us sketch of a boiler, with the grate and bridge arrangements, which he thinks must be defective, since he has trouble keeping up steam. He wishes us to suggest a remedy. *A.*—We can see nothing the matter with the grate or bridge for burning sawdust and such material. If you were using good wood all the time we would expect that better results could be obtained by extending the grates farther forward. The present arrangement gives ample combustion-chamber which is needed for sawdust, and cannot be improved on to any material extent. Probably the engines are taking the steam faster than the boilers can make it without crowding. We lean to this view of the case.

(262) J. B., Lake George, complains that he was nearly murdered by cinders during part of a railroad journey from New York to Lake George, and that during other portions of the trip the passengers experienced no discomfort. With blood and cinders in his eye against the offending roads, he calls for an explanation of how one locomotive throws no sparks, while another emits an endless shower, inflicting untold misery upon the passengers behind it? *A.*—There are two leading methods of arresting sparks, one works on the idea of preventing them from leaving the fire-box, the other aims to make the stack catch everything that goes through, paying no attention to fire-box arrangements. One system prevents sparks, the other plan fails to catch them. Then the kind of firing has a good deal to do with spark throwing. Heavy firing that takes a sharp blast to cut the fire will throw sparks in spite of the best netting, cone or water legs ever constructed. Then a locomotive deficient in heating surface must have an intensified blast to make steam, and no stifling ever devised will prevent such an engine from throwing sparks. If J. B. will interview the master mechanic of the offending railroad he will probably find that the locomotives suffer from all the defects alluded to as conducive to spark throwing. Or the locomotives that did not throw sparks may have burned hard coal.

Business Specials.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Presses & Dies, Ferracute Mach. Co., Bridgeton, N.J.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

James W. See, Consulting Engineer, Hamilton, O.

Steam Economy—124 pp., in boards. By mail, $1. A. Wilkinson, Manayunk, Pa.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

For sale, 25" lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Universal grinders for lathe-centers, chucks, angles or cylinders. C.C. Hill, 144 La Salle st., Chicago, Ill.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Castings furnished for 18" and 21" swing engine lathes. Gearing turned and cut if desired. C. F. Batt, Phœnixville, Pa.

Patents and Engineering.—E. P. Robbins, M. E., Cincinnati, O., mechanical engineer and expert, patent solicitor and expert. ☞ Special attention given to perfecting inventions.

Young men wishing to take a mechanical course or learn the machinist's trade, call or address School of Mechanical Instruction, No. 195 Front street, Worcester, Mass.

Speed and drill lathes, 10"x4', new design. Self-clamping rest, first-class material and work. Parties about to buy will do well to inquire. C. Wing, Greenfield, Mass.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

Reed's Sectional, Removable Steam Pipe and Boiler Covering. Send for circular and prices to C. C. Cowpland & Co., No. 744 Broadway, New York, agents for the States of New York and Northern New Jersey.

We will pay 25 cents each for copies of the issue of January 21, 1882, that are in good condition. Those kind enough to forward us copies of the above date will please write name and address on the wrapper for identification. AM. MACHINIST Publishing Company, 96 Fulton Street, N. Y. City.

Wanted—Correspondence with engine builders, boiler makers, and supply dealers in steam goods. We manufacture the *cheapest* Injectors and best Steam Jet Pumps in this country, and offer to *live men* the most liberal terms ever named. Drop postal for particulars to J. B. Sheriff, Son & Co., 68 Water St., Pittsburg, Pa.

"Useful Information for Steam Users"—a 100-page illustrated pamphlet, carefully compiled from the best authorities, on the care and management of the steam engine and boiler, with hints for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, New York.

Chordal's Letters.—John Wiley & Sons, 15 Astor Place, New York, have now ready a new and enlarged edition, with six additional plates, of Chordal's Letters, comprising the choicest selections from the series of articles entitled "Extracts from Chordal's Letters," which have appeared in the columns of the AMERICAN MACHINIST; with a steel portrait of the author, and upwards of fifty original illustrations by Chas J. Taylor. One volume 12 mo. of nearly 400 pages, cloth, $2.00. Will be mailed and prepaid on the receipt of the price.

Credits.—Ealy's "Blue Book," July, 1883, just published, contains a complete classified list of over 100,000 names of machinists and dealers in machinery, railway machinists, engine and boiler makers' supplies, brass goods, metal, etc., in United States and Canada. The book is condensed making it much more convenient to handle than a larger agency book. It gives the financial standing and paying qualities of all dealers and manufacturers in the above-mentioned lines of trade. For terms, etc., address The John W. Ealy Company, 51 Chambers street, New York, or 79 Dearborn street, Chicago, Ill.

Manufactures.

Money is being raised at Union, S. C., for building a cotton mill.

Rockingham, N. C., has four cotton factories in operation, and still another is to be built.

The Champion Roller Mill Company, just incorporated, will erect a 150 barrel mill at Richmond, Ind.

The Shumway and Burgess Bolt Company, Chicago, Ill., have increased their capital stock to $300,000.

The Stanley Rule and Level Company, New Britain, Conn., are about adding two new boilers to their plant.

A movement looking to the organization of a company to build a flouring mill at Granville, Texas, is on foot.

The Deane Steam Pump Company, Holyoke, Mass., have moved their Philadelphia office to 49 North Seventh street.

A company have taken the Minerva Blast Furnace at Kinnickinick, Wis., and propose in connection with it to start a nail mill.

It is stated that the Scranton Steel Works, Scranton, Pa., use as a fuel dust from a mine near by, which costs only ten cents per ton.

The Boston and Maine Railroad Company will put up temporary workshops in place of those destroyed by fire at Charlestown, Mass.

The Diebold Safe and Lock Company, Canton, Ohio, have purchased two acres of land, upon which they propose to erect a building 100x250 feet.

The Adrian (Mich.) Brick and Tile Machine Company are building new shops 300x46 feet. Their work is principally making outfits for brick and tile yards.

There is talk in Baltimore, Md., of the erection of large car works at Curtis Creek, near the former city. The Baltimore and Ohio Railroad offers to start the works with an order for 2,000 cars.

A water-works company has submitted a proposition to the authorities of Cleburne, Texas, to build a system of water-works and rent it to the city for sixteen years at $4,000 per year.—*The Tradesman.*

The Water-Works Department of St. Petersburg, Russia, have had two large pumping engines made by the Geo. F. Blake Manufacturing Company, New York, at work for a year past, and have recently ordered a third.

The Richmond Machine Works, Richmond, Ind., have issued a new descriptive circular, according to their yearly custom. They manufacture balanced circular slide valve engines, portable engines, steam pumps, saw mill work, etc.

The Hartford *Courant* in noticing the exhibition of the Bernstein Electric Light Manufacturing Company of Boston in the former city says: "It is proposed to organize a branch of the present company for the State of Connecticut in this city."

The work of building the repair shops of the Providence and Worcester Railroad, at Valley Falls, R. I., will begin at once. Five brick buildings, comprising a machine shop, a wood shop, blacksmith shop, boiler shop and offices, will be erected.

The Goss Marine Works, which started up at Bath, Me., about three months since, are employing seventy men. They are making the machinery for a steam whaler, and are quite busy on boiler work. There is talk of a yard for iron ships near the works.

The improved Korting induction condenser, illustrated in our issue of June 30, 1883, has recently been supplied to the following parties; Howard Iron Works, Buffalo, N. Y.; American Pin Company, Waterbury, Conn; Stevens & Thompson, North Hoosic, N. Y.

Among the iron and steel exhibits at the Chicago Railway Exposition that of the Ewald Iron Company of Tennessee, although badly crowded into insufficient space, attracted attention for its excellency. Their exhibit consisted of sheet iron from charcoal blooms, fire-box and flue sheets and axles and tires.

The largest rolling mill shears in the United States was recently set up by the Judson Manufacturing Company, at Oakland, California. These shears were manufactured in the Judson Works. The weight is eighteen tons, and the shears can cut a bar of iron four and a half inches square.—*Chicago Journal of Commerce.*

Forbes & Curtis, of Bridgeport, Conn., manufacturers of the Forbes patent die stock, are running full time, and contemplate enlarging their works shortly. They are now engaged upon a 6" power screw machine for the Atlas Engine Works; also two 12" cutting-off machines for the National Tube Works Company, together with a number of special machines. We are informed that their die stocks are giving general satisfaction.

The *Commercial Bulletin* says: "Some time since a certain large cotton manufacturer of Worcester County set a number of spindles in bolsters made of Wells chemical bronze. These spindles were run 1,000 turns per minute for one week without oiling. With the ordinary bolster it is necessary to oil twice a day, but since the above test these spindles have been oiled once per week with the most satisfactory results. The result of a test of the tensile strength of this bronze shows that it will sustain about 20,000 lbs. more per square inch than gun metal." The Wells Chemical Bronze Works are located at Worcester, Mass.

Sterling Elliott, Newton, Mass., has with his other specialties commenced the manufacture of a new cutting-off tool for small stock. His printed remarks about this tool are worth noting as a model of brevity and good sense. They are as follows: "It is not possible for a child to do more work in an hour with this tool than an expert machinist could do in all day with a $600 cutting-off machine, but I may safely say that in the hands of a man of ordinary intelligence it will be found sufficiently useful to fully justify the investment of $4."

In our issue week before last, we noticed the purchase by a new company, the Rochester Machine Tool Works, of the shop, patterns and plant of Geo. B. Brettell, Rochester, N. Y., the intention of the company being to continue the building of iron planers and other machinery. We now learn that the new company got its charter, and became fully organized July 7th, 1883, the officers being Elias Mapes, president; John Buckley, vice president; Edwin R. Bryant, secretary; and George W. Davison, treasurer. Mr. Davison was for thirteen years connected with the Providence Tool Company as selling agent, while Mr. Bryant was formerly with William Gleason as foreman. Messrs. Bryant, Buckley and Mapes are practical machinists of long experience, and have been for the past two years with Mr. Brettell, holding a pecuniary interest in his business.

The Southwark Foundry and Machine Company, Philadelphia, write us: Our works are filling up very rapidly with valuable orders. We recently took an order for 100 of the new Clerk gas engines from two to twenty-five horse-power. We are selling a large number of Porter-Allen engines, many of them of large size. We exhibited at the Chicago Railway Exposition an engine driving the Edison and Thomson-Houston dynamos, which showed a most extraordinary performance. At the Louisville Exposition we have a 300 horse-power engine for electric light purposes. At the Boston Institute we shall have a 100 horse-power engine to represent us. We are building three large blowing engines, and a great quantity of miscellaneous heavy work. In the department of sugar machinery, for which, for so many years, these works took high rank, estimates have lately been made for plants aggregating three-quarters of a million dollars. The handsomely illustrated new work on High-Speed Engines, but recently issued by us, has excited such an interest among scientific men and engineers as to call for another edition. The application of a vigorous organization and new economic methods in the shops have enabled the Southwark Company to produce their Porter-Allen engines at about an equal cost, for the smaller sizes, with other first-class engines, and for the larger sizes, above 250 horse-power, at a less cost, power for power, than any first-class engine.

Machinists' Supplies and Iron.

NEW YORK, July 19, 1883.

In supplies, business continues moderately good, without material changes in prices. The prices of files have been advanced 5 per cent.

In iron we quote standard brands of No. 1 X Foundry at $22 to $23; No. 2 X, $19.50 to $20.50 at tide water, and Grey Forge, $17.50 to $18.50 at furnace. In Scotch Pig the market is quiet, with prices slightly in favor of the sellers. We quote: Glengarnock, $22.50 to $23; Coltness, $24 to $24.50; Gartsherrie, $24; Summerlee, $23 to $23.50; and Eglinton, $21 to $21.50.

Spelter rules dull, with Common Domestic, $4 50 to $4 70; Refined, 8c. to 8¾c.; Silesian, 5c. to 5⅛c.

For Tin the market is steady, with quotations: Banca, 22c.; Straits and Malacca, 21⅜c. to 21½c., and Billiton and Australian, 21⅜c.

Antimony is in light demand, with prices favoring buyers. We quote holders' prices: Hallett's, 9⅝c., and Cookson's, 10⅝c., but actual sales are at lower figures.

Lake Copper is quoted at 15¼c. to 15½c., and 14c. to 14¼c. for other brands.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue

Wanted, Tool Maker—A good workman can find permanent employment. Joel Hayden Brass Company, Lorain, O.

Wanted—A first-class pattern maker. Steady work to right man. Address, Birmingham Iron Works, Birmingham, Ala.

Mechanical draughtsman desires engagement. Six years' practical experience; technical education; age 25; good references. Address, W. H., AMERICAN MACHINIST.

Situation Wanted—In a small machine shop, by a young draughtsman, where he could have an opportunity to obtain an interest in the business. Address, Interest, AMERICAN MACHINIST office.

A mechanical draughtsman, with shop experience, desires position. Steam engine work preferred. Address, Swede, 1049 Superior street, Cleveland, O.

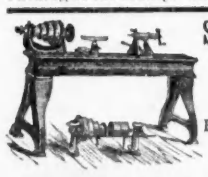
Wanted—A first-class foundry foreman. Must be a good workman. To the right man it will be a steady job. Four dollars a day at first, and more as he makes the foundry profitable. Address, Birmingham Iron Works, Birmingham, Ala.

Wanted—A superintendent for a manufacturing company, whose specialty is engine builders and steam-heaters' brass goods. We want an educated mechanic, of good executive ability and temperate habits, competent to manage from 100 to 150 brass finishers. Apply by letter, with references and indorsements, to Buckeye Iron and Brass Works, Dayton, O.

Wanted—By an old and well-established machine shop in Southern Pennsylvania a first-class mechanical engineer and draughtsman who has had long practical experience in designing and building automatic cut-off engines, steam boilers and portable engines of various kinds, also other machinery; must be a good designer generally, and furnish the best of references both as to character and efficiency. Address Box 9, care AM. MACHINIST, 96 Fulton street, New York.

Wanted — A No. 2 second-hand Root Blower. Tozer & Dial, Columbia, S. C.

Light and fine interchangeable machinery to order. Foot and power lathes; slide rests, &c. Catalogue for stamp. Edwd O. Chase, Newark, N. J.



Superior 10, 12 & 16 in.
SPEED LATHES.
Built by RAY & SCOTT,
DEXTER, MAINE.
Send for Description.

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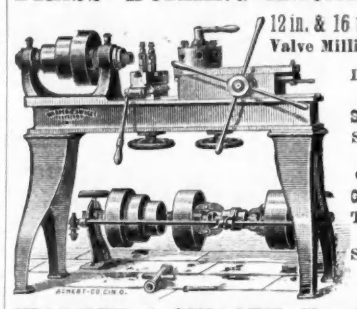
All Sizes, Independent, 4-Jaw Combination Universal Geared and Lever. Brass Finishers' 2-Jaw, from 4 in. to 9 in. Chucks for Cutting-off Lathes, Screw Machines, and Amateur Lathes. Centering and Drill Chucks.
SEND FOR CATALOGUE.

TO LEASE—WATER FRONT, MILE and a half in extent, docked and ready for immediate use; within twenty miles of New York City, on Long Island Sound, having railroad as well as water communication. Manufacturers and others needing much or little room can have suitable accommodation, with long lease, at nominal rent. The introduction of manufacturing interests upon the property the primary object of the owners.
Further particulars can be had on application to the agents, RULAND & WHITING, 5 Beekman st., New York.

BRASS WORKING MACHINERY.



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Revolving Chucks for Globe Valves,
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Small Tools and Fixtures.

WARNER & SWASEY, Cleveland, O.

COOKE & CO., DEALER IN Machinery & Supplies,

22 CORTLANDT ST.,
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Greenfield Vertical Engines
2½ to 30 Horse Power.
Unequaled in workmanship and quality of material. Prices lower than any other first-class engine.
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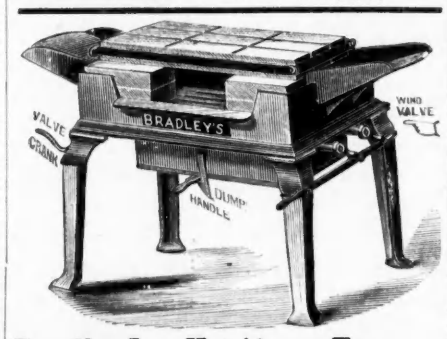
Please send for circular and state that you saw the advertisement in this paper.



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FOR HARD COAL OR COKE,
BRADLEY & CO., - Syracuse, N. Y.

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—RELATING TO—
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DESCRIPTIVE CATALOGUE, 100 PAGES, 1883, SENT FREE ON APPLICATION.
E. & F. N. SPON, 35 Murray St., N. Y.

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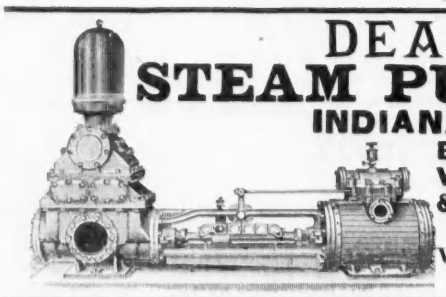
Oil Manufacturers,

We make a specialty of compounding oils for high-speed engines and all purposes not in the ordinary line of machinery.

Samples Submitted Free. Established 1822.



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INDIANAPOLIS, IND.
Boiler Feeders, Fire Pumps, Vertical Pumps, Air Pumps & Condensers, Water Works Pumps.
WRITE FOR CATALOGUE & PRICES.

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Knowles' Steam Pump Works

HAVE REMOVED TO THEIR NEW QUARTERS,

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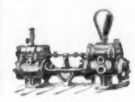

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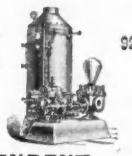

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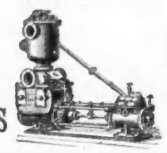

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STEAM PUMPING MACHINERY
For Every Possible Duty.

UNION STONE COMPANY,

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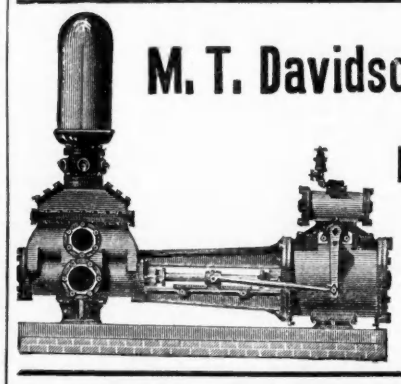

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6 in. and 8 in. Hand and Power.
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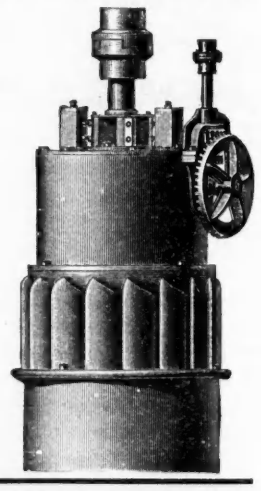

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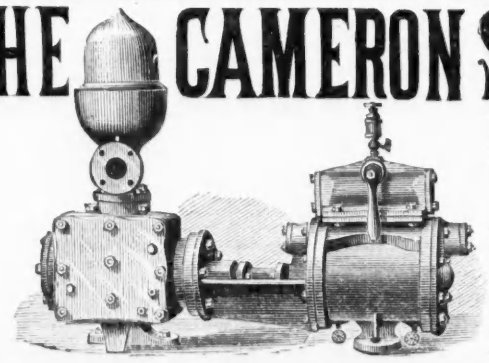

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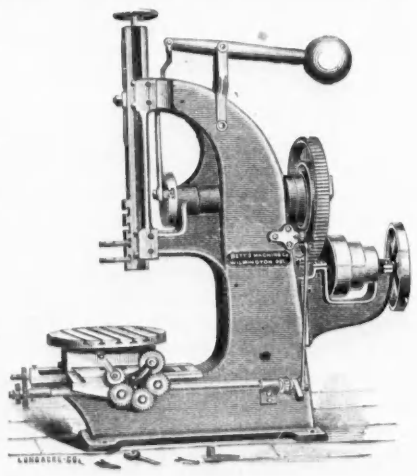

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THE BABCOCK & WILCOX CO.
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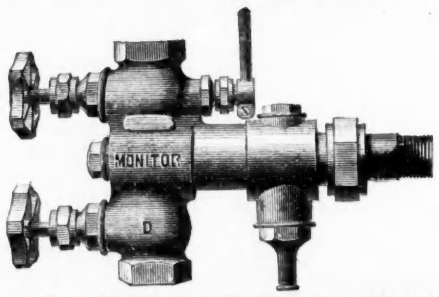

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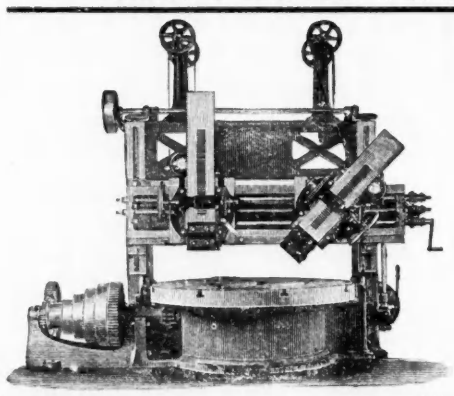

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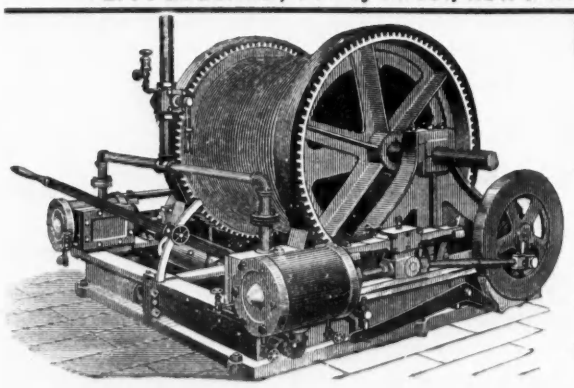

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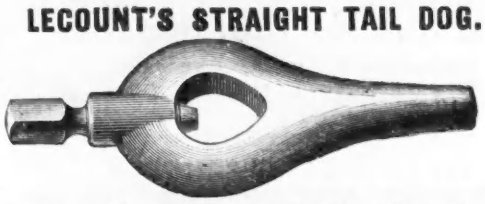

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" 3,	1 "	.80	" 12,	3 "	1.80
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" 5,	1¼ "	.95	" 14,	4 "	2.30
" 6,	1⅜ "	1.10	" 15,	4½ "	3.00
" 7,	1½ "	1.10	" 16,	5 "	3.50
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" 9,	2 "	1.40	" 18,	6 "	5.00

1 Set to 2 inches, $9.05 Full Set, $34.10
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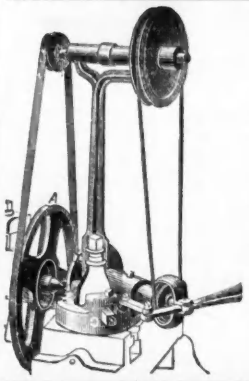

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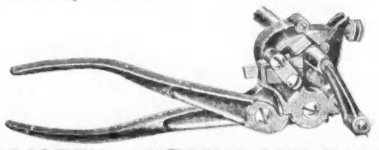
Hack all round it with a cold chisel, then whale it over the anvil until something gives out. Another way is to use



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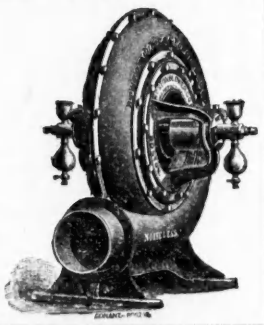

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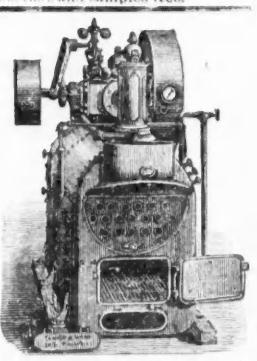

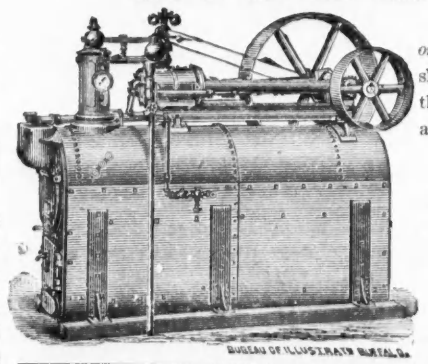

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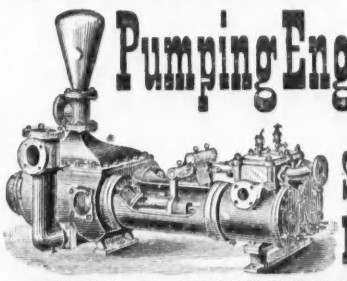

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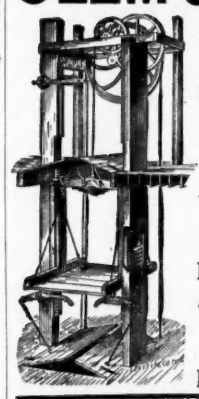

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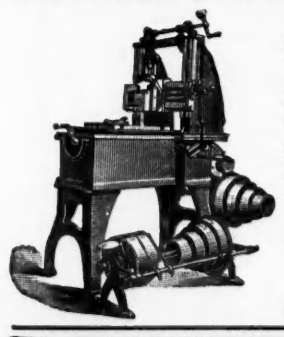

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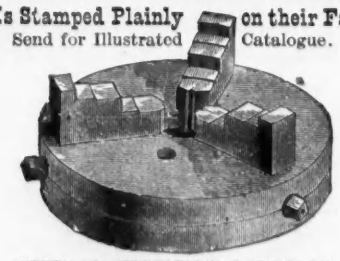

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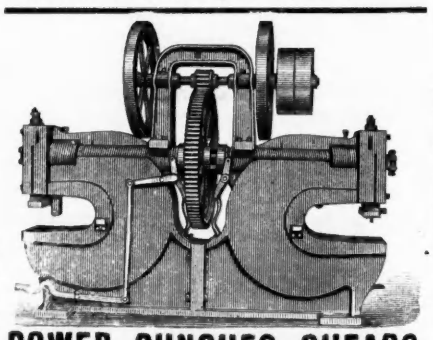

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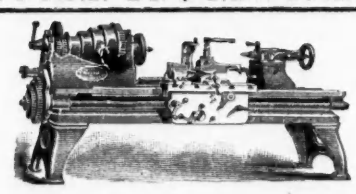

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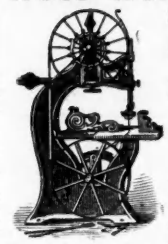

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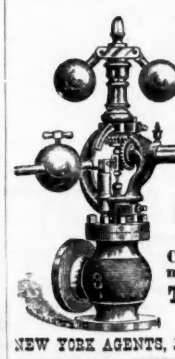

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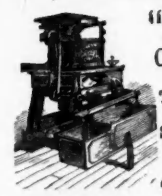

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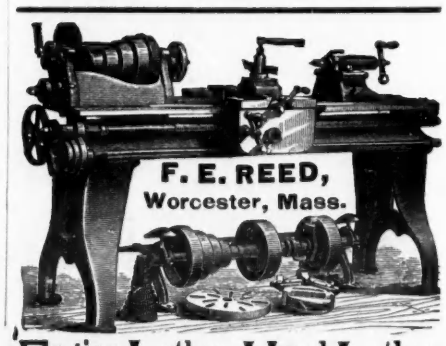

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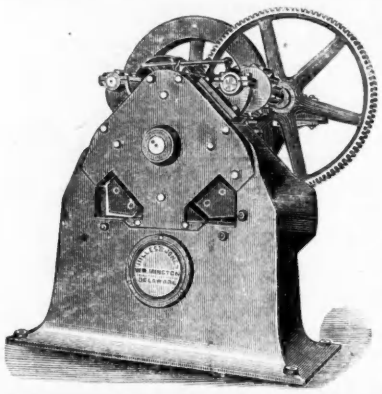

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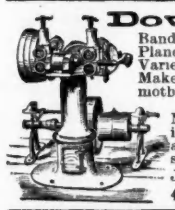

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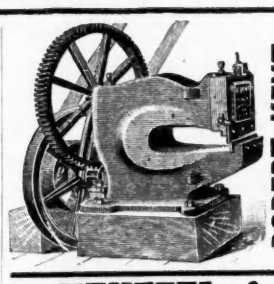

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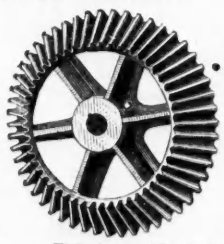

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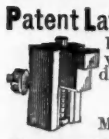

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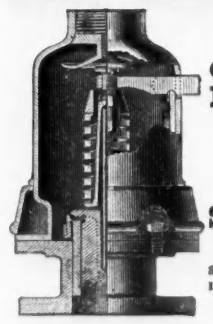

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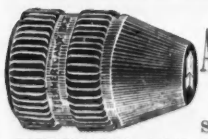

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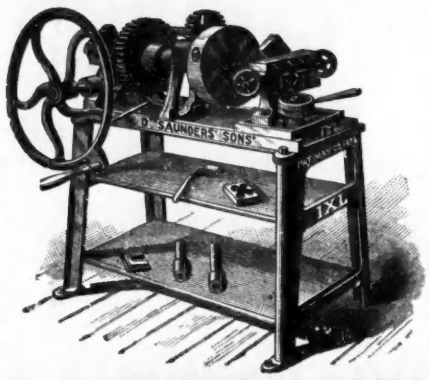

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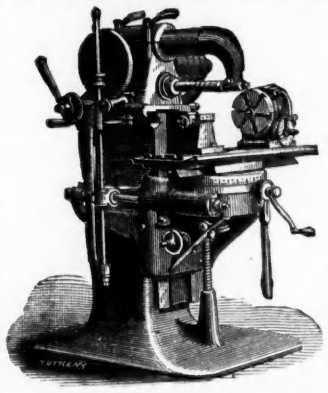

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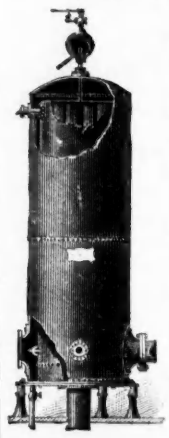

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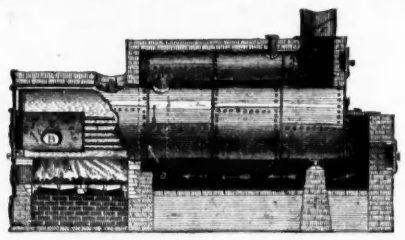

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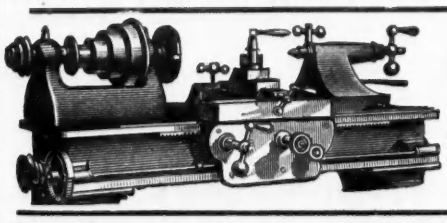

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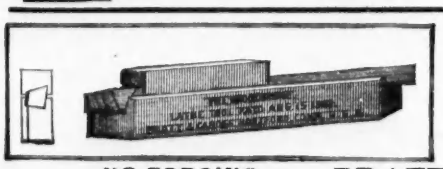

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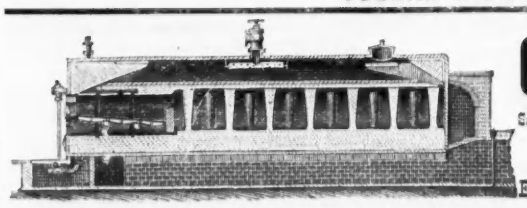

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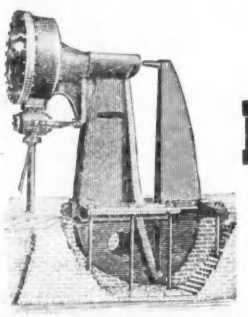

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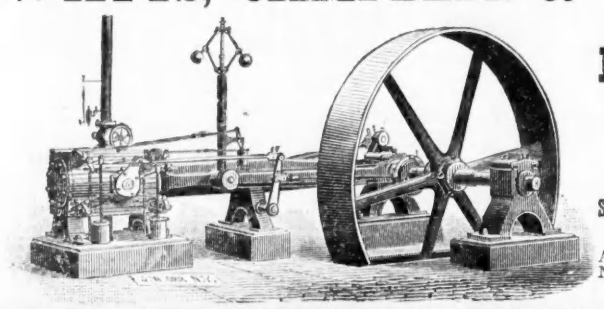

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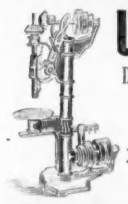

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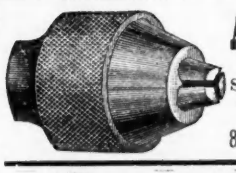

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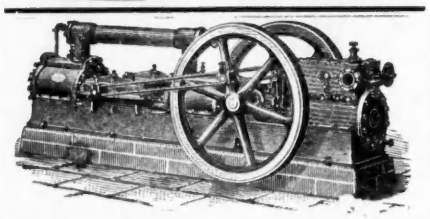

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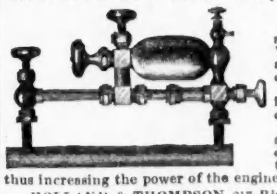

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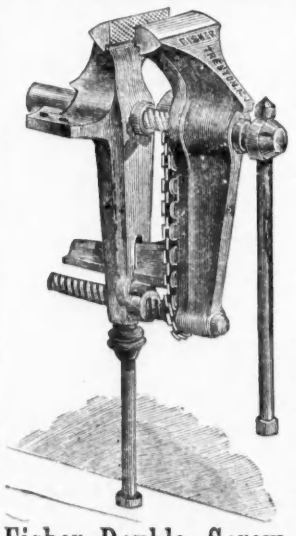

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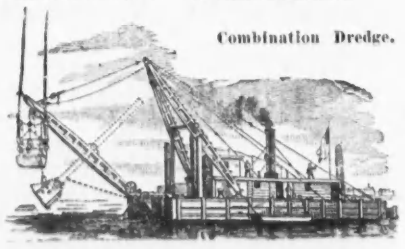

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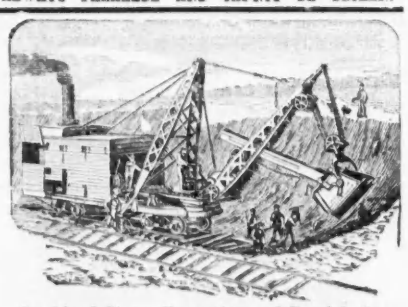

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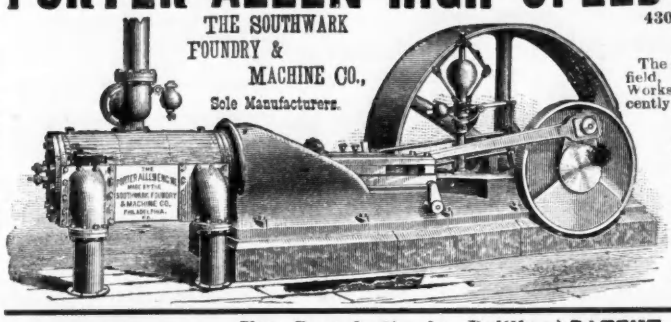

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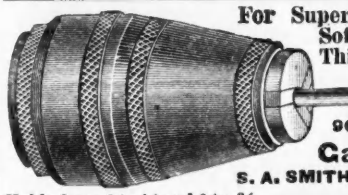

For Superiority in Drilling Soft or Hard, Thin or Thick Metals use the **PATENT FLUTED DRILL.**

For Lathe Work it is unexcelled. In boring, counterboring, reaming, or to countersink, the highest testimonials are given. Made by UNION TWIST DRILL CO., 96½ SUMMER STREET, BOSTON, MASS., Agents for

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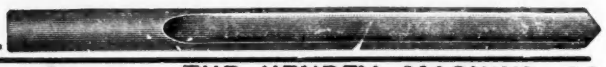
Holds from 0 to ⅛ and 0 to ¾.

No Key or Wrench required.



Fox, Turret and Speed Lathes

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Swivel Head Engine Lathes,

(18 and 26 in. from new patterns.)

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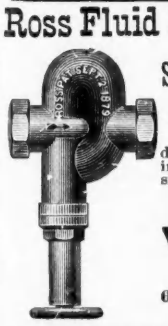

FOR Steam, Water, Air and Gas.

Automatically reduces the pressure in pipes to any desired extent.

ROSS VALVE CO.

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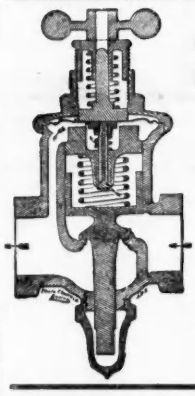

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Pressure Regulator

For Steam, Water and Air,

MANUFACTURED BY

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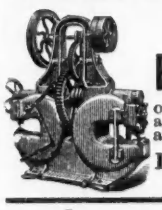

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of beautiful design, of great strength and capacity, and thoroughly reliable, address

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MANUFACTURERS OF

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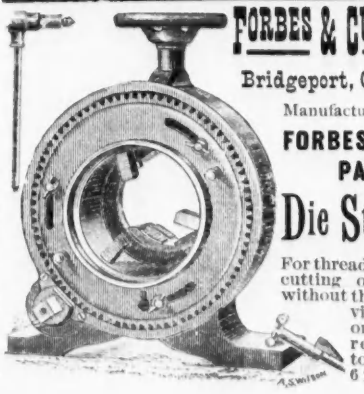

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FORBES' PATENT

Die Stocks

For threading and cutting off pipe without the aid of vise. Only one man required to thread 6 in. pipe.

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15, 24 and 30 in. Shapers.

4 ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 6 ft. x 26 in., 8 ft. x 26 in. and 8, 10, and 12 ft. x 30 in. Planers.

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AMATEURS' HAND PLANERS, SHAPER AND PLANER CENTERS, SLIDE RESTS, &c.

UPRIGHT DRILLS

16 to 60 Inches Swing.

BORING AND TURNING MILLS

To Swing, 48, 66 & 84 in.

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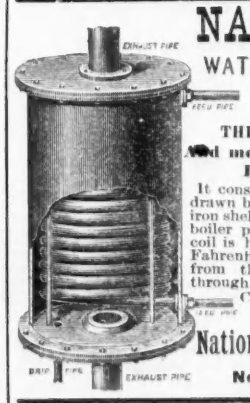

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THE CHEAPEST, BEST and most Effective Heater In the Market.

It consists of a coil of seamless drawn brass tube contained in an iron shell. The feed water for the boiler passing through the brass coil is heated up to 212 degrees Fahrenheit, by the exhaust steam from the engine, which passes through the shell.

Circular and Price List sent on application.

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"OTTO" GAS ENGINE.

OVER 8000 IN USE.

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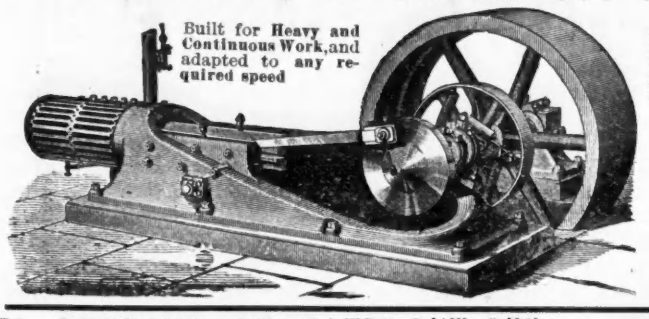
THE HARTFORD AUTOMATIC CUT-OFF ENGINE.



Built for Heavy and Continuous Work, and adapted to any required speed

Close regulation and best attainable Economy of Fuel. Circular and Practical Treatise on Steam Engineering sent on application.

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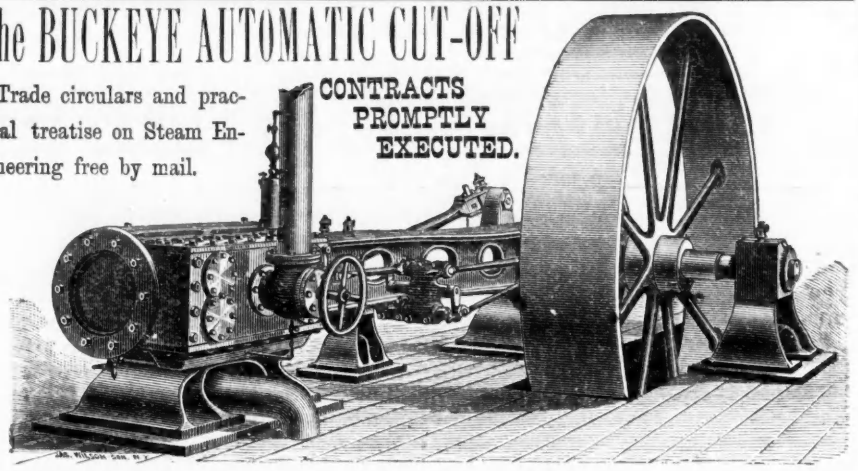
The BUCKEYE AUTOMATIC CUT-OFF

Trade circulars and practical treatise on Steam Engineering free by mail.

CONTRACTS PROMPTLY EXECUTED.



These Engines are carefully constructed for heavy and continuous duty, at medium or high rotative speeds. Highest attainable economy in consumption of steam, and superior regulation guaranteed.

Address, BUCKEYE ENGINE CO., Salem, Ohio.

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THE KORTING EXHAUST-STEAM-INDUCTION CONDENSER.

Always reliable. Send for circular.

Will lift water without any pump. Operates equally well when supply flows to condenser from one foot fall or more. Requires no hot well, no elevated tail pipe, or tank. The most satisfactory results obtained.

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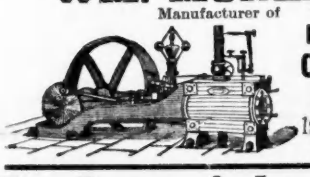

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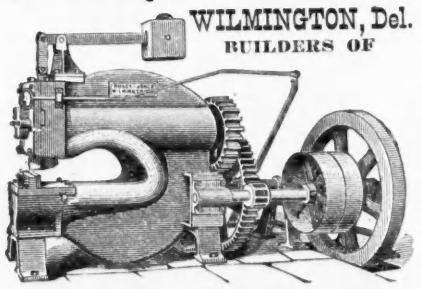

STEAM ENGINES,

Boilers, Tanks, Machinery for Rolling Mills, Punches, Shears, Riveters, Angle Iron Cutters, Cranes, and heavy Iron Work generally

Iron Working Machine Tools

42 in. x 16 ft. and 20 ft. Triple Geared Engine Lathe. Ames. New.
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24 in. x 10, 12, 14 & 20 ft. Engine Lathe. New. Ames.
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20 in. x 8, 10, 12 and 14 ft. " " Ames. New.
20 in. x 8 ft. Engine Lathe. Fifield.
20 in. x 10 ft. Lincoln Engine Lathe. Good order.
17 in. x 8 ft. " " " " "
16 in. x 6, 7, 8, 10 and 12 ft. Engine Lathe Bridgeport.
1 13 in. x 4 ft. Engine Lathe, Rod Feed. P. & W. Good order.
27 in. x 27 in. x 6, 7, 8 ft. Planers. Ames. New.
26 in. x 26 in. x 7 ft. Planer. Brettell. New.
24 in. x 27 in. x 6, 7 and 8 ft. Planer. Ames. New.
22 in. x 22 in. x 5 ft. Planer. Ames. New.
16 in. x 16 in. x 42 in. " Bridgeport. New.
12 in. Stroke Crank. " Belden. Second-hand.
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10 & 20 in. Stroke Shaper. Gould & Eberhardt.
42 in. Radial Drill. Box. New.
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One 12 in. x 12 in. Vertical Engine. N. Y. S. S. Pow. Co. Second-hand.

New York Agent,
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Write full particulars of what is wanted.

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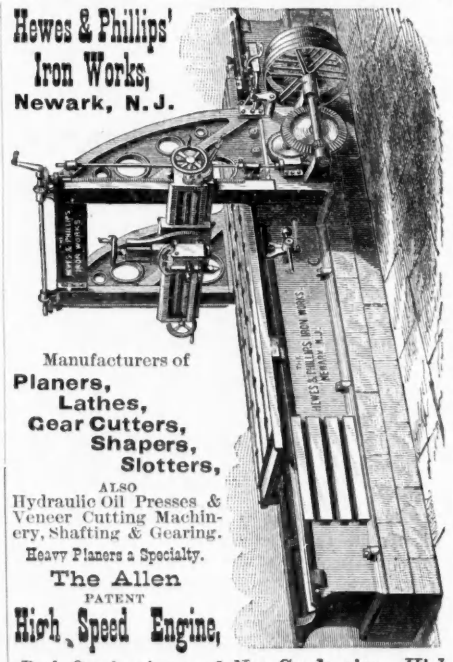

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ALSO
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Heavy Planers a Specialty.

The Allen PATENT
High Speed Engine,

Both Condensing and Non-Condensing. High economic duty and fine regulation guaranteed. Tubular Boilers and Steam Fittings.

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Sole Manufacturers of **Oil Cups for Locomotives, Marine and Stationary Engine Cylinders,** under the Seibert & Gates Patents, with Sight Feed.

TAKE NOTICE.

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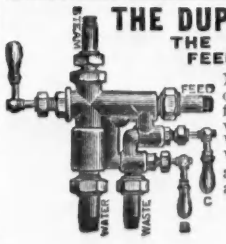
All parties are hereby notified to desist the use, manufacture, or sale of same, as we shall vigorously pursue and prosecute all infringers.

THE DUPLEX INJECTOR,

THE BEST BOILER FEEDER KNOWN.



Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler Will start when it is hot. Will feed water through a heater. Manufactured and for sale by

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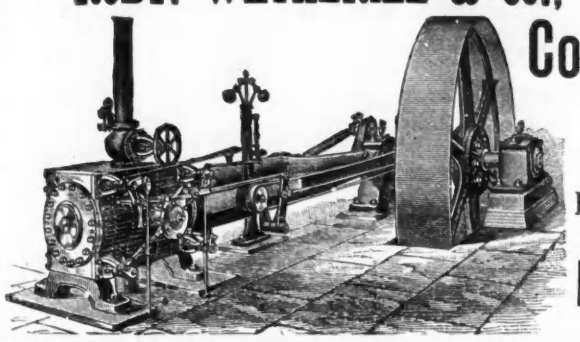

Corliss Engine Builders,

Condensing, Non-condensing, and Compound.

HIGHEST EFFICIENCY AND GREATEST ECONOMY.

Boiler Makers.

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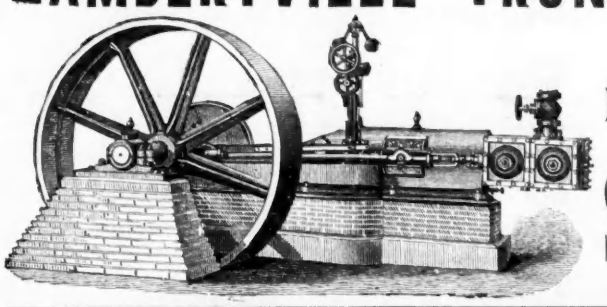

A. WELCH,
Manufacturer of
Patent Automatic
CUT-OFF
Steam Engines
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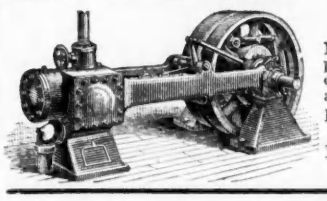

STRAIGHT LINE AUTOMATIC CUT-OFF ENGINE;

Medium or high speed; uniform at all ranges of power or steam pressure; the fewest parts and working joints; the best material correctly distributed, and unexcelled in workmanship, balance, and smooth running.

For Eastern and Southern States, apply to the
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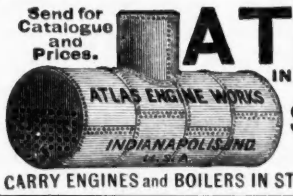
M. C. Bullock Manufacturing Co., Chicago, Ill.

Send for Catalogue and Prices.



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MANUFACTURERS OF
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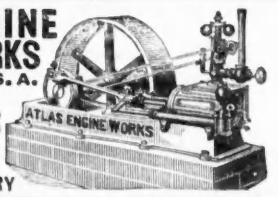

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1 Engine Lathe, 14 in. x 6, 7 & 8 ft. Grant & Bogert.
1 each " " 26 in. x 9, 12 & 14 ft. Grant & Bogert.
1 " " 45 in. x 15 ft. Good Order. [New
1 " " 36 in. any length of bed.
1 " " 15 in. x 6 ft. New
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1 " " 16 in. x 6, 7 & 8 ft. "
1 " " 18 in. x 8 & 10 ft. Lodge & Barker "
1 each Engine Lathes, 20 in. x 10 and 12 ft,
1 " " 24 in. x 10 ft. New.
1 " " 28 in. x 18 ft. New.
1 " " 24 in. x 12, 14 and 16 ft. New.
1 " " 11 in. x 4 ft. & 5 ft. Prentiss. New.
1 each. Plain Engine Lathe 16 in. x 4 ft., & 6 ft. "
1 15 in. x 4 ft. Turret Lathe. Lodge & Barker.
1 13 in. x 4 ft. Turret Lathe.
1 Fox Turret Lathe, 16 in. x 6 ft. Lodge & Barker. New.
1 Planer, each 24 in. x 24 in. x 5 x 6 ft. Second-hand.
1 " 22 in. x 20 in. x 5 ft. new
1 " 24 in. x 24 in. x 6 ft. Hendey. "
1 " 26 in. x 26 in. x 7 ft. "
" " 30 in. x 30 in. x 8 ft. 2nd Hand.
1 " 36 in. x 36 in. x 10 ft. Good Order.
1 16 in. Lever Table Drill. New.
1 each 16, 20, 22 & 24 in. Upright Drills. Prentiss.
1 19 in. Upright Drill. Blaisdell.
1 each 25, 28 & 34 in. B. G. & S. F. Dril's. Blaisdell.
1 each 9, 12 and 18 in. Shapers. Prentiss.
1 each 10 and 15 in. Shapers. Gould & Eberhardt.
1 each 15 & 24 in. Shapers, Hendey. New.
Full assortment Milling Machines, Spindle Drills, &c., of Garvin's.
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1 Hand Lathe, 16 in. x 6 and 7 ft. New.
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1 Gray's Screw Machine, to take all sizes to 1 in.
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All kinds Machinists' Small Tools and Supplies.

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CRAIG'S HYDRAULIC GOVERNOR,

FOR STEAM ENGINES,
The Most Perfect Governor Known.

RUNS IN OIL.

Guaranteed to accurately regulate all classes of engines.

Illustrated and descriptive Catalogue sent on application. Correspondence solicited.

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Sole Manufacturers,
LAWRENCE, MASS.

E. G. FELTHOUSEN,

BUFFALO N. Y.
Manufacturer of
Patent Ratchet Drill,
Flue Cleaners, Gauge-Cocks, Cylinder Oil Pumps, &c.

SIMPLE, STRONG AND DURABLE.
Extra Sleeve to Increase Length of Body.
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S. ASHTON HAND,

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MAKER OF FIRST-CLASS
ENGINE LATHES

Is now in position to put on the market
14" ENGINE LATHES OF NEW DESIGN
guaranteed to be equal in material, design and workmanship to the best ever offered.

FOR SALE.

We have the following second-hand Machinery for sale, viz.:

One Planer to plane 61 in. x 61 in. x 20 ft. long.
One Planer to plane 54 in. x 54 in. x 16 ft. long.
One Planer to plane 15 ft. long 51" wide very good.
One Iron Planer, to plane 12 feet long, 36 in. x 32 in. in fair condition.
One Iron Planer, to plane 12 feet long, 30 in. x 30 in.
One Engine Lathe, will take 14 feet between centers, and swing 53 in over ways, has hollow spindle, and is adapted for both turning and boring, with countershaft. Complete.
One Engine Lathe, will take in 11 feet, 6 inches between centers, swings 48 inches over shears, and 32 inches over carriage. It has internal gear, and cross-feed, with countershaft. All complete.
One 3 ft. bed, 9 in. Foot Power Screw Cutting Lathe, with tools.
One Slotting Machine, 12 in. stroke, slots to the center of 46 in. Adjustable table and universal feed motion.
One Combined Power Punch and Shears, to punch ⅝ and ½, and shear ½ in. iron.
Two No. 2 Pratt & Whitney Milling Machines. Very good.
One Axle Lathe, Fitchburg Machine Co.
One 12 in. Shaper, Lowell Machine Shop.
One No. 1 Brown & Sharpe Screw Machine.
Two 4 in Spindle Drills.

Send for List of New Machinery.

The George Place Machinery Co.,
121 CHAMBERS AND 103 READE STREETS, NEW YORK.

BROWN & SHARPE MFG. CO.

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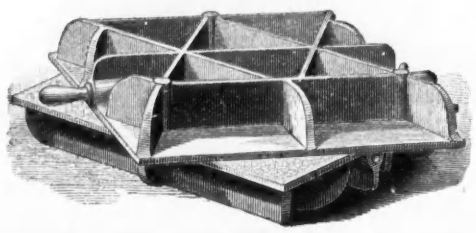
Manufacturers of the

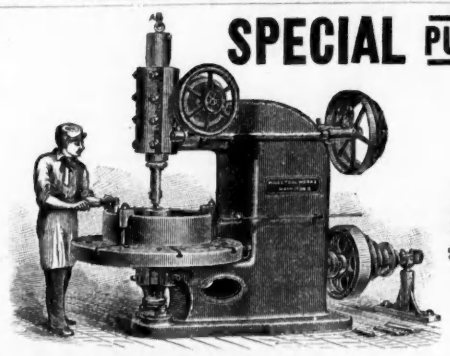


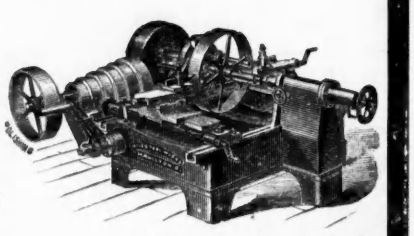
STANDARD SURFACE PLATES.

9″x 9″	$12	12″x 18″	$33
6½″x 18″	18	16″x 16″	40
10″x 15″	25	10″x 30″	45
14″x 14″	30	24″x 24″	88

SPECIAL PULLEY MACHINERY.

36, 50 & 60 in. Swing.





NILES TOOL WORKS, Hamilton, O. Chicago, March 19th, 1883.

Gentlemen:—We have been using continuously for the past two years the **FIFTY-INCH PULLEY MACHINES** purchased of you, and they have not cost us a cent in the way of repairs. We have turned out as high as **19 pulleys ranging from 20 to 28 inches in diameter and from 6 to 8 inches face in 10 hours. Have turned 8 pulleys 48 x 8 inches in 10 hours.**

The manufacture of pulleys comprises quite a large part of our business, and we looked over the field considerably before purchasing of you, and this, with two years' experience, enables us to say, we think them **THE BEST PULLEY MACHINES** in the market.

Very truly yours, **W. McGREGOR & CO**

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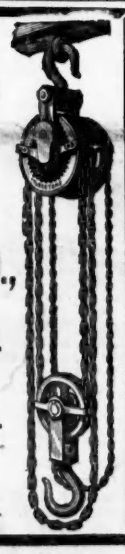

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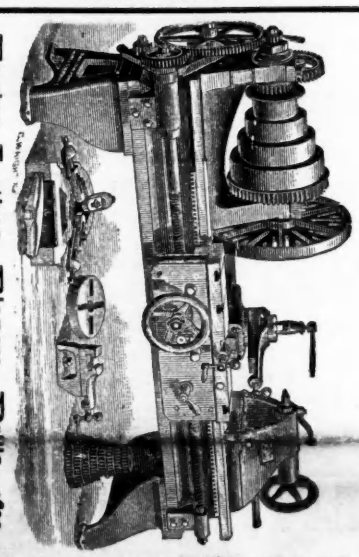

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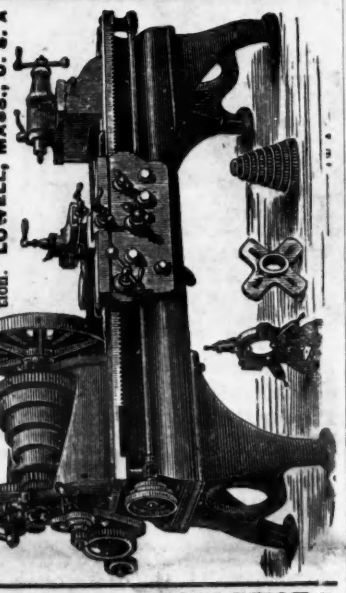

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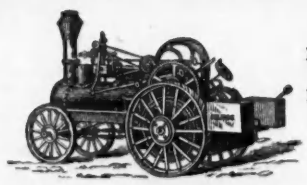

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